APRIL 1953

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Vol. 11 No. 4

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Published monthly by the TECHNICAL PUBLISHING COMPANY, an affiliate of INDUSTRIAL PUBLISHING COMPANY, publishers of APPLIED HYDRAULICS, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, COMMERCIAL REFRIGERATION AND AIR CONDITIONING. Member Controlled Circulation Audit, Inc. Not responsible for unsolicited editorial material. Indexed regularly by Engineering Index, Inc.

Subscription rates: United States and possessions—$3.00 per year; $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year. Subscriptions in the United Kingdom £1.10 per annum, payable in Sterling to our London office. Single copy price 30 cents. All subscriptions subject to individual acceptance by the publisher.

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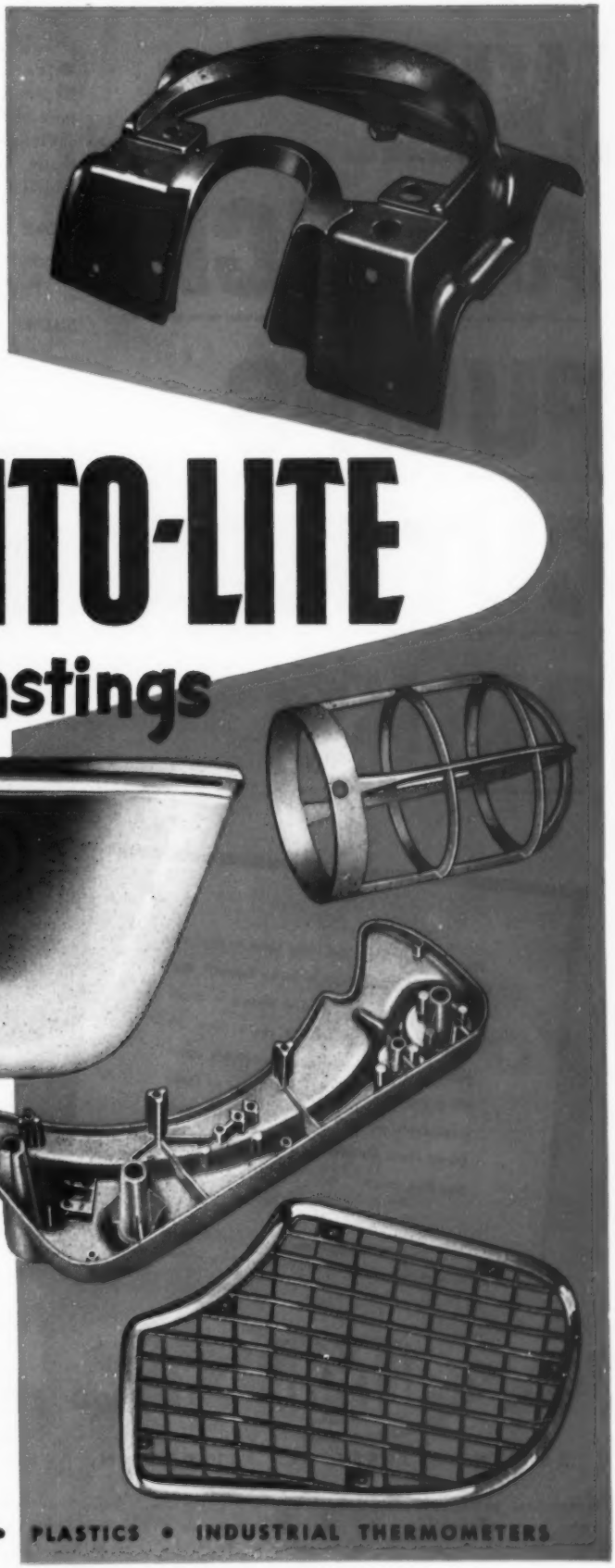

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Fluid ends are sectionalized . . . parts can be replaced easily and at low cost. To facilitate changes in pressure and volume requirements, *plunger sizes are easily changeable* . . . in most cases changing them is simply a matter of using new glands, throat bushings and packing in the same fluid end. And, *wearing parts are interchangeable* . . . helping to reduce spare parts costs and inventories particularly when combinations of multiplex pumps are employed.

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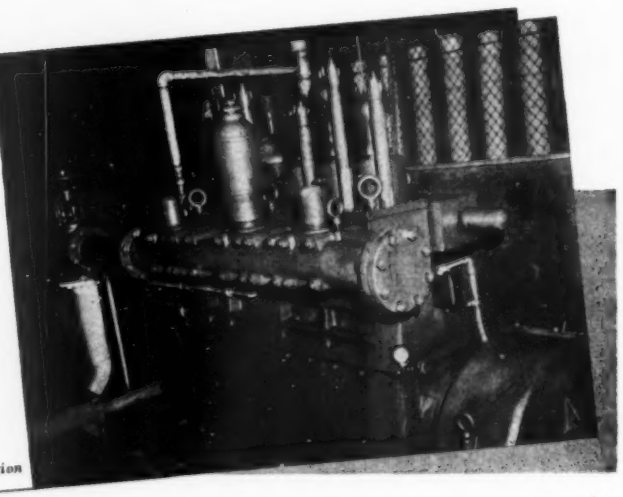
Photograph courtesy of Doehler-Jarvis Corporation



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Between the Lines

in this and future issues of PMM

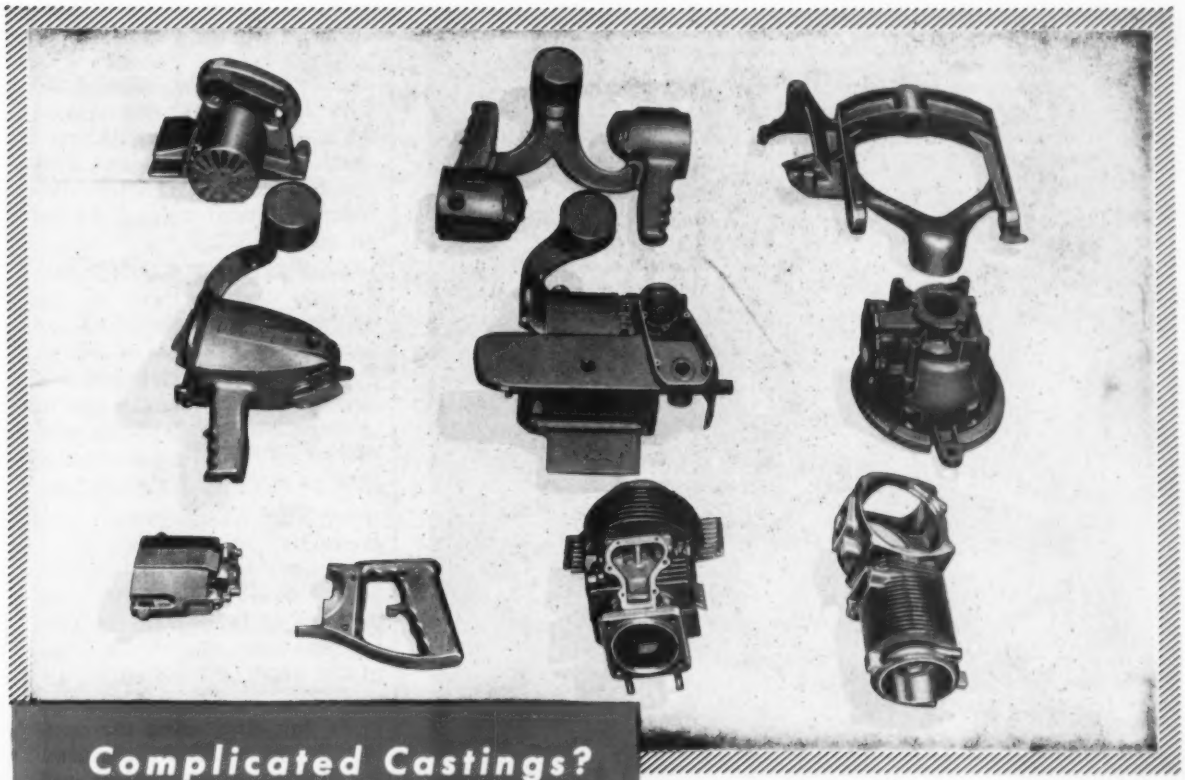
— VARIATION in casting methods are frequently introduced as the need for some feature not possible by conventional methods occurs. Thus, permanent mold casters often use sand cores for complex internal shapes in what is usually called "semi-permanent mold" casting. Investment casting has, currently, three important variations of technique depending upon type of pattern used. In this issue of PMM a specialized type of aluminum casting method called "The Antioch Process" is introduced. For large complex shapes that have to be highly accurate it has much to recommend it. It draws some of its techniques from sand molding and some from plaster mold casting. The article begins on page 44.

— MUCH CONTRADICTORY information has been heard concerning barrel finishing methods and principles. In an attempt to simplify and outline some basic principles relating to one important factor in barrel finishing, PMM this month has a comprehensive report on how to choose barrel finishing compounds for processing metal parts. It begins on page 94.

— IMPORTANT among cost-cutting methods now available to the product designer are parts produced from metal powders. It will pay to keep this issue with its complete directory of the powder metallurgy industry near at hand for reference. The directory opens on page 57.

— SPECIAL TECHNICAL REPORT each month appears in the rear portion of PMM. The editors will present discussion of some technical prob-

continued on page 10



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SPECIFICATIONS MODEL 400-B

Size of Die Plates	Space Between Bars	Die Opens	Maximum Die Space	Capacity Per Shot (Lbs.)	Net Wt. (Lbs.)
38"x38"	23"x23"	16"	42"	2.2 to 12.2 (Al)*	40,000

**NOTE: The model 400-B handles brass and magnesium die casting as well. Complete specifications on request.*

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lem in each issue. Started the first of the year, this special feature has already attracted much favorable comment. This month's feature on pattern dies for investment casting begins on page 115.

—— SHELL MOLDING data for the designer will be the subject of an article scheduled for the May issue of PMM. Nearly a dozen articles on this new field of casting are now in preparation and will be presented by PMM as a regular feature of its editorial section.

—— SILICONES that have created so much interest as an ingredient of auto polish and other consumer items, are proving to be immensely varied in their usefulness. One of the important industrial applications of silicones appears to be for lubricating die casting dies at high temperatures. An article on this subject will be offered in the May issue of PMM, together with performance records.

—— A MARKET SURVEY conducted by PMM has revealed some very impressive statistics concerning the tonnage of small iron sand castings that are produced each year. Facts disclose that an important portion of these gray and malleable iron castings could, very conceivably, be redesigned for more economical production by one of the precision metal molding methods. Take a look at this important survey which starts on page 29.

—— WISE DESIGNERS look at new methods of fabricating to save them money. Attention is called to the use of brass sinterings for small plumbing components. One company's experience replacing extruded and machined pieces with sinterings starts on page 34.

—— WHAT DO YOU EXPECT from a housing? An article on page 46 illustrates some of the things you might expect to get from a die cast housing.

Selection Factor in Choosing Alloys for Die Castings

		Aluminum Alloys ASTM Nos. S5, SC2	Brass	Magnesium Alloys ASTM Nos. 12 and 13	Zinc Alloys ASTM Nos. 21, 23, 25
Mechanical Properties	Tensile strength	3	1 (Strongest)	3	2
	Impact strength	3	1 (Toughest)	3	2
	Elongation	4	1 (Most ductile)	3	2
	Dimensional stability	2	1 (Most stable)	3	3[a]
	Resistance to cold flow	2	1 (Most resistant)	2	3
	Brinell hardness	3	1 (Hardest)	3	2
Physical Constants	Electrical conductivity	1 (Highest)	2	3	2
	Thermal conductivity	1 (Highest)	2	4	3
	Melting point	2	1 (Highest)	2	3
	Weight, per Cu in.	2	4	1 (Lightest)	3
Casting Characteristics	Ease, speed of casting	2	3	2	1 (Easiest)
	Maximum feasible size	1 (Largest feasible)	2	1 (Largest feasible)	1 (Largest feasible)
	Complexity of shape	1 (Greatest possible)	2	1 (Greatest possible)	1 (Greatest possible)
	Dimensional accuracy	2	3	2	1 (Most accurate)
	Minimum section thickness	2	3	2	1 (Thinnest)
	Surface smoothness	2	3	2	1 (Smoothest)
Cost	Die cost[b]	2	3	2	1 (Lowest)
	Production cost	2	3	2	1 (Lowest)
	Machining cost	2	3	1 (Lowest)	1 (Lowest)
	Finishing cost[c]	3	2	3	1 (Lowest)
	Cost per piece[d]	2	3	2	1 (Lowest)
Extent of Use		2	4	3	1 (Most used)

Source: Materials & Methods

a *Through the use of a low temperature annealing treatment, Alloy No. 23 can be made virtually stable in dimensions.*

b *Dies for casting the low melting point alloys are least expensive and have longest life.*

c *Includes polishing and buffing expense as well as ease of applying all types of commercial finishes, both electrodeposited and organic.*

d *Based on die, material and fuel costs, production speed, machining and finishing costs.*

ZINC is the most adaptable metal for the die casting process and provides the best combination of physical and chemical properties. Zinc die castings are stable, strong, and can be cast to close tolerances; they are easily machined and a large variety of beautiful metallic and organic finishes can be readily applied to the castings. Industry's recognition of these factors is indicated by a two-hundred-fold increase in the use of zinc die castings in the last ten years, plus the fact that nearly 70% of *all* die castings by weight are made of zinc.

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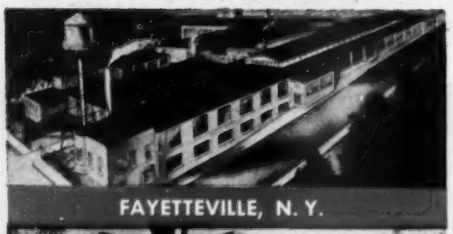

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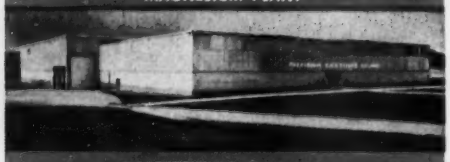

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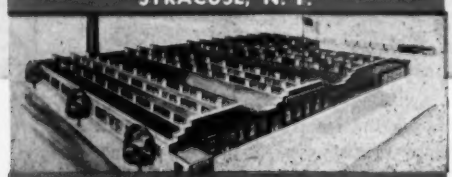

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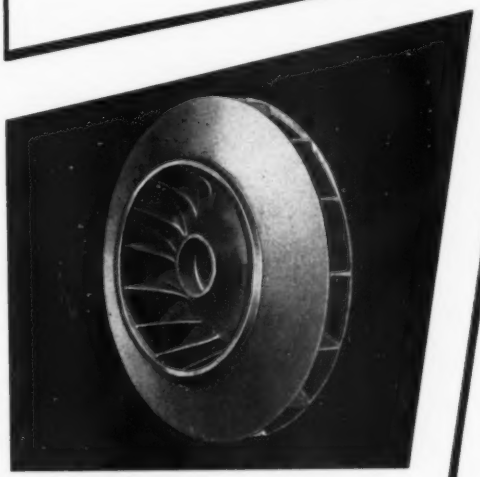
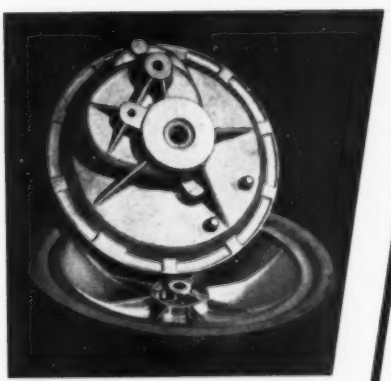


A typical ACME casting for a defense product. Fin sections have a wall thickness of 3/16"



These two castings are machined and assembled as a gear case housing for a peace-time application.

For either defense or peace-time production ACME of Chicago offers a complete casting service including aluminum alloy permanent mold and semi-permanent mold castings and aluminum and magnesium sand castings.

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We produce light metal castings weighing from a few ounces to hundreds of pounds.

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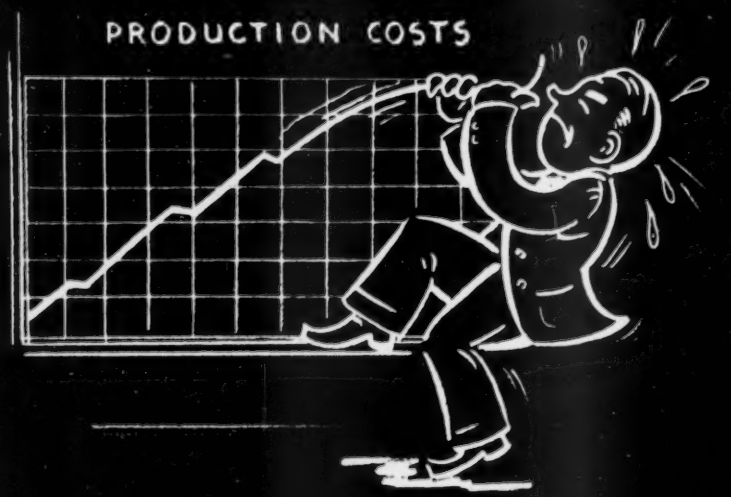

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Consider the advantages of zinc and aluminum alloy die castings . . . if you want to lower your assembly operations and keep your costs down.

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Detroit, Mich.
Trinity 5-7474

J. S. Hanna
Rochester, N. Y.
Monroe 3392

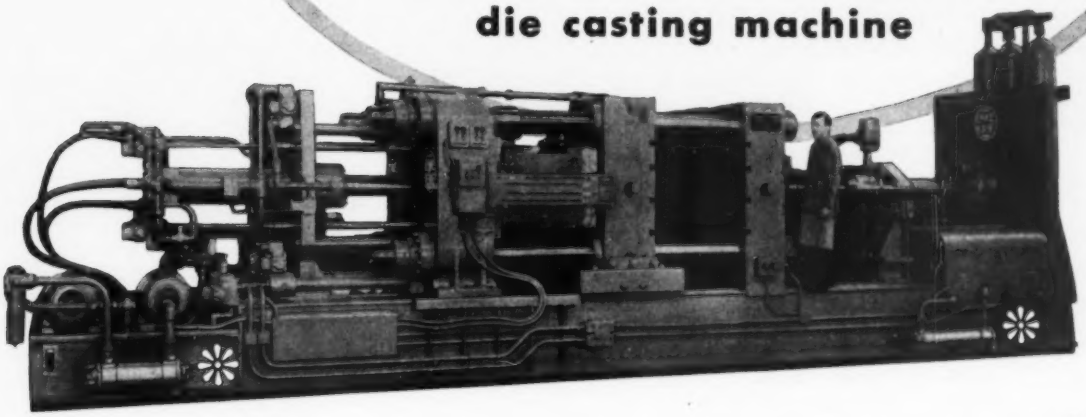
Manufacturers Sales
Dayton, Ohio
Melrose 3-4902

John Keefe, Jr.
Camden, N. J.
Woodlawn 4-2316

For additional information Circle No. 22 on the Reader Service Card

holding hydraulic fluid temperatures in check

in this new 1000 ton Lake Erie die casting machine



. . . 2 ROSS EXCHANGERS*

By "stepping up hourly production 15% to 25%" — this new Lake Erie 1000 ton Cold Chamber Die Casting Machine is reportedly setting new standards for low finished-casting costs.

To hold hydraulic fluid temperatures in check under all conditions — *to prevent overheating* — Lake Erie Engineering Corp. furnishes 2 Ross Exchangers: One serving the 1000 lb. pumping system at the die closing end (left, above) and the other serving the 2000 lb. pumping system at the shot end (indicated on right). *No lost capacity through pump slippage here!*

The same features that make Ross Type BCF Exchangers the choice for Lake Erie die casting machines make them the choice for hydraulic machinery of other leading manufacturers: Ruggedness . . . durable all-copper and copper alloy construction . . . a large selection of pre-engineered, fully standardized designs to meet most requirements.

For more facts, request Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1446 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

KEWANEE-ROSS PRODUCTS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

For additional information Circle No. 25 on the Reader Service Card

Six Big Benefits Obtained from DIE CASTING

CASE HISTORIES FROM MT. VERNON FILES

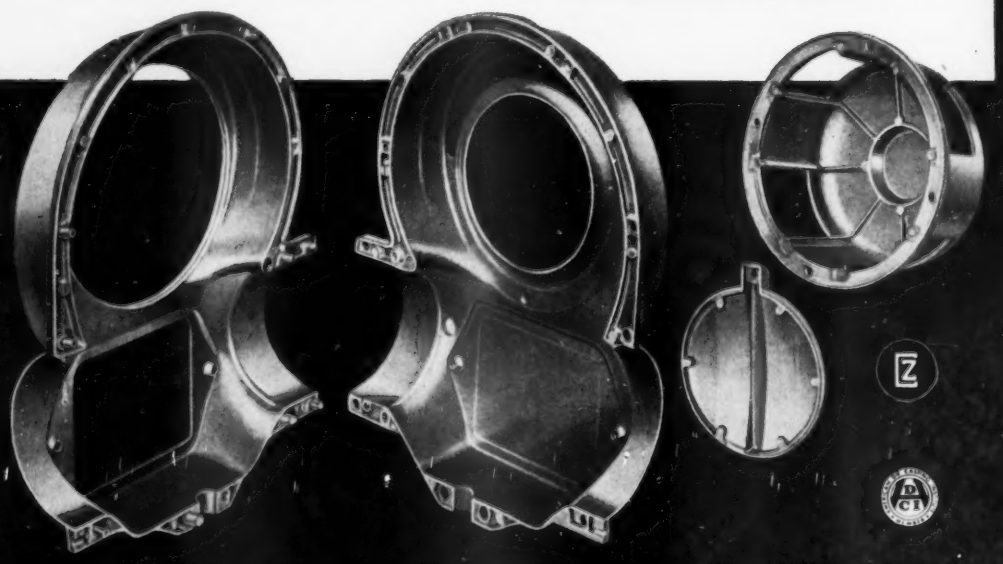
Here's what Burn-Rite Products Co., of Yonkers, N. Y., makers of Burn-Rite oil burners, says: "We find that as a result of switching to die casting, we profit by the following:

1. Product weight held down to minimum—permitting substantial freight savings. (Formerly, 87 lbs., now weighs 75 lbs.)
2. Greater ease of assembly—due to decrease in weight of parts.
3. Savings due to accuracy of die casting, which reduces cost of tooling, machining, and handling.
4. Smooth-surface castings which present a finer painted finish.
5. Less employee fatigue—due to easier handling of lighter parts.
6. Increased production *without* additional increase in help.

To these six big advantages, you can add a seventh: Mount Vernon's Complete Four-fold Service, (*a*) *consultation*—to help with design and production problems; (*b*) *die making*—on modern tool and die equipment handled by skilled personnel; (*c*) *castings*—guaranteed "on grade" at all times; (*d*) *machining facilities*—for handling every machining operation castings may require.

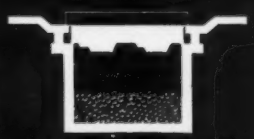
A switch to die casting may profit you tremendously, too. Why not consult with us?

MT. VERNON
DIE CASTING CORP.
MT VERNON NEW YORK



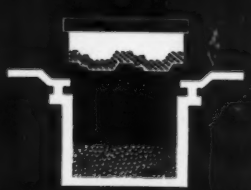
For additional information Circle No. 29 on the Reader Service Card

LOADING THE MOLD-MAKING MACHINE WITH RESIN-SAND MIXTURE.



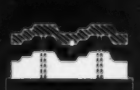
HOT PATTERN PLATE CLAMPED TO MOLD-MAKING MACHINE

INVERTING MACHINE TO DEPOSIT RESIN-SAND MIXTURE ON HOT PATTERN



REMOVING PATTERN PLATE WITH ADHERED SAND-RESIN CRUST

OVEN-CURING FRESHLY FORMED MOLD HALF



EJECTION PINS REMOVING CURED MOLD HALF FROM PATTERN PLATE

How SHELL MOLDING Pays off!

The shell molding process offers notable economies to the producer and user of ferrous and non-ferrous castings on short as well as long runs.

LONG RUN PRODUCTION. Shell molds yield castings almost pattern-smooth, with tolerances as close as .003 to .005 inches per inch. This feature greatly reduces finishing costs. Moreover, there is a high percentage of sound, uniform castings, with fewer rejects.

SHORT RUN PRODUCTION OF COMPLEX SHAPES. Such castings normally require finishing entirely by hand—at prohibitive cost. Shell molds are made of a resin-sand mixture that is perfectly suited to forming on intricate pattern plates. Shell molds can be stored without deterioration for intermittent production scheduling. They retain their shape until used.

SELECTION OF PROPER RESINS. BAKELITE Phenolic Resins are used to bond the fine-grained sands from which the thin, lightweight shell molds are made. Bakelite Company has developed several resins for this process, of which two meet most requirements. One provides resistance to distortion during the initial heat of pouring. The other provides accurate reproduction of intricately-detailed patterns, even those requiring deep draws.

ENGINEERING GUIDANCE. Selection and use of the correct bonding resin is important to successful shell molding. It is a step for which your foundry department or supplier may need expert guidance. Bakelite Company engineers, located in principal cities, are ready to help. Write Dept. PK-60.

BAKELITE
TRADE-MARK

PHENOLIC RESINS FOR SHELL MOLDING

TRADE MARK

BAKELITE COMPANY

A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

For additional information Circle No. 14 on the Reader Service Card

You Don't Have To Add Skilled Manpower To Your Production Team

. . . to get die castings like these

Our engineering staff would welcome the opportunity to help you with your needs. Just drop us a line for prompt, practical assistance.

Here's basic die casting data for engineers and designers. Use company letterhead and write for your copy today.

NEWTON NEW HAVEN

THE NEWTON-NEW HAVEN COMPANY

689 THIRD AVENUE WEST HAVEN 16 CONNECTICUT

For additional information Circle No. 51 on the Reader Service Card

LETTERS TO THE EDITOR

SURFACE FINISH STANDARDS

During a recent discussion with members of our Quality Control and Purchasing Departments on permanent mold and die cast aluminum castings, the subject of surface finish specifications in the as-cast condition was brought up. In the past, Engineering has not specified any degree of smoothness for the surface of the casting, primarily because a micro inch finish specification does not seem to be adaptable to cast surfaces. Surface finish for the casting has usually been the result of discussions with the molder during development of the item and is the result of a mutual agreement of what is considered acceptable.

We have been requested to investigate surface finish standards as accepted in the permanent mold and die casting industry. If such standards are available, will you please advise where same may be obtained. Any additional information you have on this subject will be greatly appreciated. — V. E. F.

ASTM B 85 - 52 T has this to say about workmanship and finish of aluminum base alloy die castings: "6. (a) Castings shall be produced with smooth surface, free from cracks and disfiguring blemishes. (b) When so specified by the purchaser, castings shall be produced by the cold-chamber process."

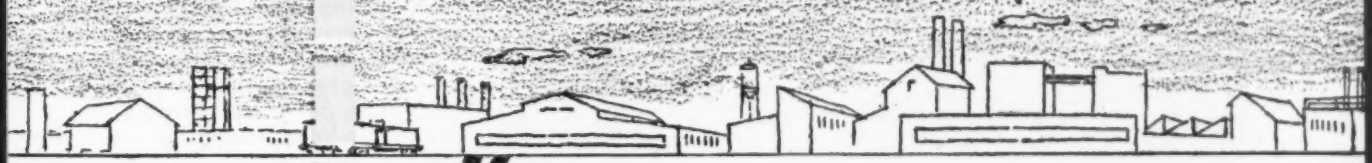
However, in his book "Die Casting," (McGraw-Hill Book Co., Inc., 502 pgs, $8.00) H. H. Doehler presents five classes of

continued on page 20

THE RIGHT WAY *to quality zinc die castings*

CERTIFIED ZINC ALLOY PLAN
LICENSED PRODUCER
AMERICAN DIE CASTING INSTITUTE

. . . and the way to be certain of "on grade" alloys . . . the CERTIFIED ZINC ALLOY PLAN



You're on sure ground when your die castings are made by a CZ Licensed Producer. No matter what your requirements, the **CZ Alloy Plan**, through constant periodic inspection and testing, guarantees their fulfillment with the proper alloy.

Any of the leading die casting firms listed here, the only licensed **CZ Alloy Plan** producers, will be glad to explain the plan to you or discuss any die casting problem you may have. A free folder, outlining in full the operation of the **CZ Alloy Plan**, will be sent upon request.

LICENSEES under the CZ ALLOY PLAN

A & A Die Casting Co., West Los Angeles, Calif.
The Accurate Die Casting Co., Cleveland, Ohio
Advance Pressure Castings, Inc., Brooklyn, N. Y.
Advance Tool & Die Casting Company, Milwaukee, Wis.
Badger Die Casting Corp., Milwaukee, Wis.
Central Die Casting & Mfg. Co., Inc., Chicago, Ill.
Cleveland Hardware & Forging Co., Cleveland, Ohio
Congress Drives Division, Tann Corp., Detroit, Mich.
Continental Die Casting Corp.,
Division of F. L. Jacobs Co., Detroit, Mich.
Crown City Die Casting Co., Pasadena, Calif.
Doehler-Jarvis Corp., Pottstown, Pa.
Doehler-Jarvis Corp., Toledo, Ohio
Dollin Corporation, Irvington, N. J.
Du-Wel Metal Products, Inc., Bangor, Mich.
Federal Die Casting Company, Chicago, Ill.
Globe Imperial Corporation, Rockford, Ill.
C. M. Grey Mfg. Co., East Orange, N. J.
Heick Die Casting Corp., Chicago, Ill.
Hilfinger Corporation, Toledo, Ohio
The Hoover Company, North Canton, Ohio
Komin Die Casting & Mfg. Co., Chicago, Ill.
Kiowa Corporation, Marshalltown, Iowa
Paul Krone Die Casting Co., Chicago, Ill.
Madison-Kipp Corporation, Madison, Wis.
Milwaukee Die Casting Company, Milwaukee, Wis.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Mt. Vernon Die Casting Corp., Mt. Vernon, N. Y.
Paragon Die Casting Company, Chicago, Ill.
Parker White Metal Co., Erie, Pa.
Precision Castings Company, Inc., Fayetteville, N. Y.
Precision Castings Company, Inc., Cleveland, Ohio
Precision Castings Corp., Chicago, Ill.
Pressure Castings, Inc., Cleveland, Ohio
Racine Die Castings Co., Racine, Wis.
St. Louis Die Casting Corporation, St. Louis, Mo.
Schultz Die Casting Company, Toledo, Ohio
Sterling Die Casting Co., Inc., Brooklyn, N. Y.
Stewart Die Casting Division
of Stewart-Warner Corp., Bridgeport, Conn.
Stewart Die Casting Division
of Stewart-Warner Corp., Chicago, Ill.
Stroh Die Moulded Casting Co., Milwaukee, Wis.
The Superior Die Casting Company, Cleveland, Ohio
The Tool-Die Engineering Co., Cleveland, Ohio
Twin City Die Castings Company, Minneapolis, Minn.
Union Die Casting Co., Ltd., Los Angeles, Calif.
Universal Die Casting Company, Los Angeles, Calif.
Wells Die Casting Co. of Calif., San Francisco, Calif.
Western Die Casting Co., Emeryville, Calif.

AMERICAN DIE CASTING INSTITUTE, INC.

366 MADISON AVENUE NEW YORK 17, N. Y.

Like Two Peas in A Pod—

Are Products Produced From Correctly Made PMD Dies

DIE CASTING DIES

(The die above shows on the left the upper section and on the right the lower section is shown assembled with cavities and gating.)

Permanent Molds and Cores • Tubular Dies • Extrusion Dies

To insure the adherence to dimensions and maintenance of standards for products manufactured in any of the ways shown above requires their production by the finest-made dies possible. PMD produces dies such as these because we have the "know-how", men with experience, and are equipped with the best of quality machine tools.

Serving Industry throughout the United States and Canada, PMD Customers include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries. Our staff of specialists is ready and able to meet your most exacting specifications for dies of the highest quality and most intricate structure.

A Complete Die Design Service Available
Write for our Illustrated Brochure

PERMANENT MOLD DIE COMPANY, INC.

22775 E. Nine Mile Road • Hazel Park Michigan • Ploneer 7-8100
(Suburb of Detroit)

For additional information Circle No. 53 on the Reader Service Card

LETTERS TO THE EDITOR
continued from page 18

surface finish, depending upon subsequent finishing to be applied and also, the end use of the casting.

In general, few buyers of die or permanent mold castings specify finish except to indicate which ones need to be free from parting lines, porosity, etc. when necessary. Naturally the higher surface finish specified, the higher will be the cost for castings due to the greater care in die maintenance, possible slower casting cycle, and increased number of rejects. Therefore, it is not in the buyer's interest to specify a finish which is of a higher quality than is actually needed. — Ed.

MORE ABOUT GOLD PLATING

In the issue of January 1953, I read, Page 4, a small article concerning "Gold Plated Die Castings" (Letters to the Editor.)

As we manufacture stainless steel watch cases by investment casting, we are subscribers to your interesting magazine. But we also use a lot of zinc die casted watch cases that we finish in our factory: finishing means polishing buffing, gold plating and lacquer spray coating.

Will you please send to my attention copies of any articles that you may have on gold plated die castings. — J. M. (Switzerland)

Articles forwarded, and sources listed. — Ed.

POROUS BRONZE SHEET STOCK

In your January issue of Precision Metal Molding we note in an article by Mr. Charles Fillinger that porous bronze sheet stock is available to industry as a stock item.

We are not acquainted with any source for this material

continued on page 129

aircraft component steel parts made from ACCUMET PRECISION INVESTMENT CASTINGS

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

ENGINEERING SERVICE AVAILABLE

Crucible engineers and metallurgists are available to assist you in solving your design or production problems by the application of these Accumet Precision Investment Castings . . . that are playing such an important part in our National Defense Program.

CRUCIBLE

53 *years of Fine steelmaking*

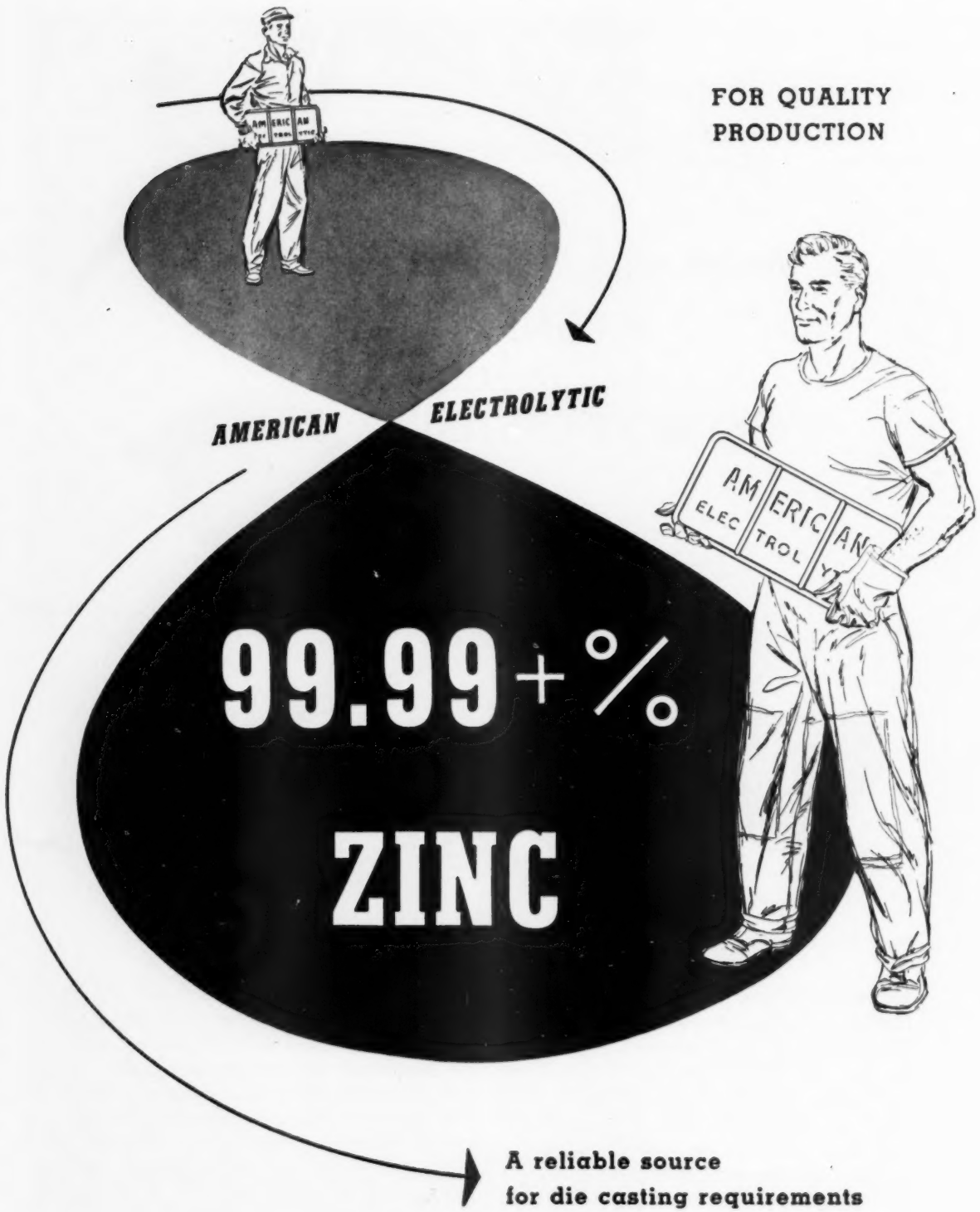
first name in special purpose steels

ACCUMET PRECISION CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

For additional information Circle No. 15 on the Reader Service Card



AMERICAN ZINC SALES COMPANY

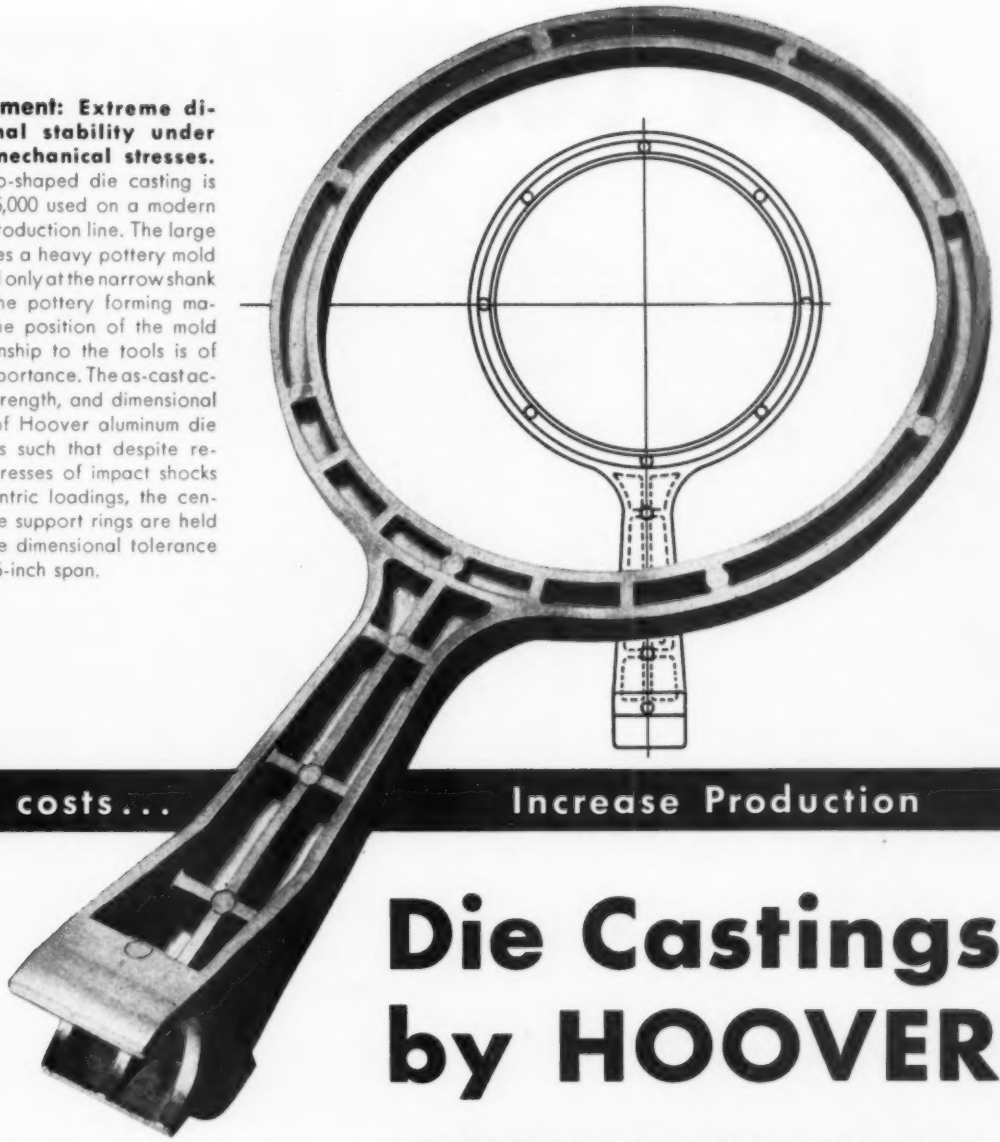
Distributors for

American Zinc, Lead & Smelting Company

Columbus, Ohio • Chicago • St. Louis • New York

For additional information Circle No. 7 on the Reader Service Card

Requirement: Extreme dimensional stability under heavy mechanical stresses. This banjo-shaped die casting is one of 15,000 used on a modern pottery production line. The large ring carries a heavy pottery mold supported only at the narrow shank end, to the pottery forming machines. The position of the mold in relationship to the tools is of critical importance. The as-cast accuracy, strength, and dimensional stability of Hoover aluminum die castings is such that despite repeated stresses of impact shocks and eccentric loadings, the centers of the support rings are held to a close dimensional tolerance over a 26-inch span.



Cut costs... Increase Production

Die Castings by HOOVER

A corner of the Hoover Die-Making Department—Hoover offers complete service in the field of die casting from original engineering design to final delivery of your product. Write for a free booklet, "Die Castings," The Hoover Company, Die Castings Division, North Canton, Ohio.

Call in a Hoover engineer to see how die castings in aluminum or zinc can help you step up your production and profits through

- reduction in number of parts.
- saving in machining time.
- saving in material costs.
- saving in assembly time.
- elimination of rejects.
- greater possibilities in engineering design.
- a better appearance for your product.

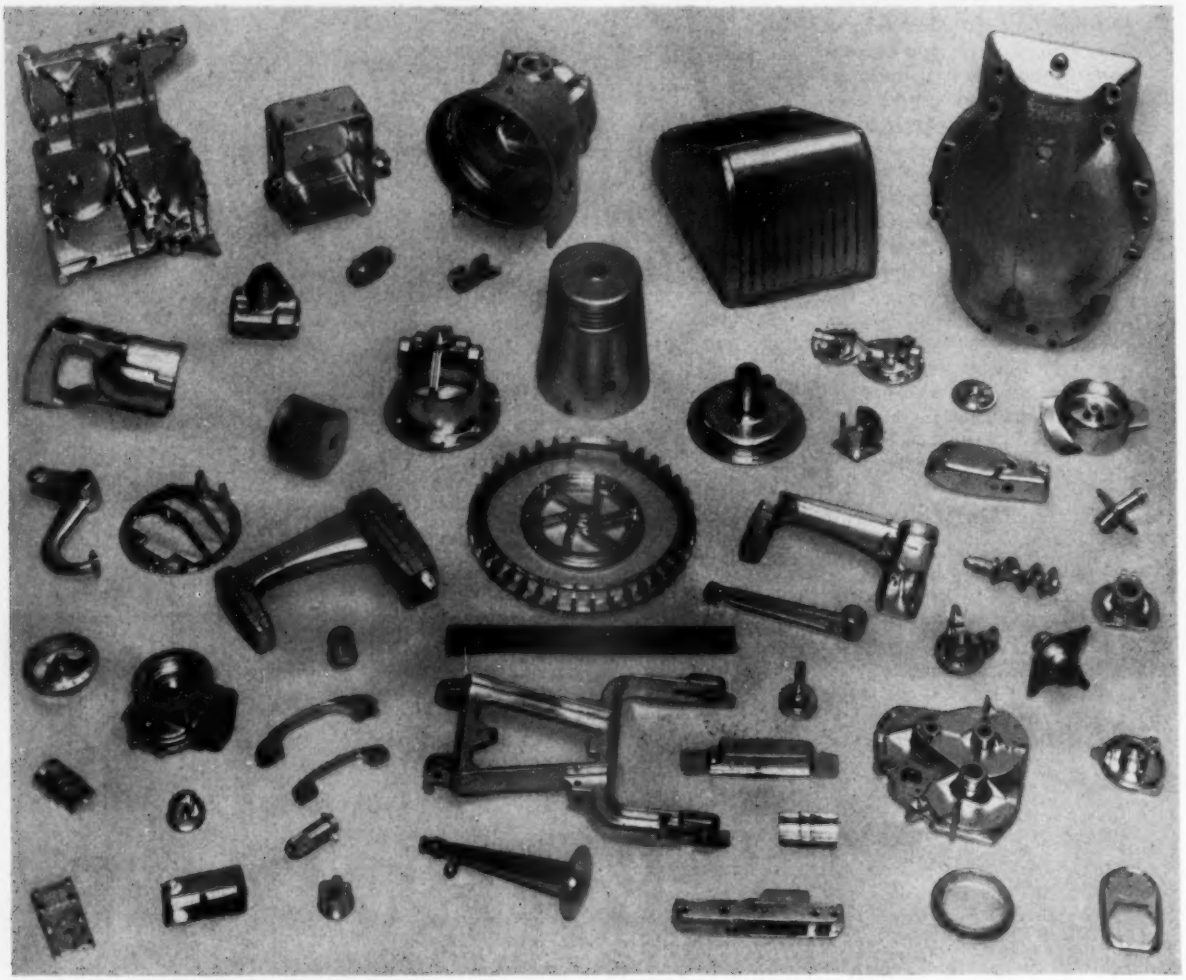
Get a bid from

HOOVER

Specialists in the field of Die Castings since 1922

For additional information Circle No. 21 on the Reader Service Card

LOW COST PARTS



Accurately Made as DOLLIN *Zinc or Aluminum Die-Castings*

Small Castings Department

• 1000 per lb. to 3 per lb. Specialized high speed, automatic equipment. Make two or more parts as one . . . reduce machining operations . . . cut piece costs. Write for Small Parts Bulletin and samples.

Leading manufacturers depend on Dollin for parts of all shapes and sizes. They know that Dollin has the experience and the facilities to capitalize on *all* the cost cutting advantages of the die-casting process. Equipment includes large cold chamber type, high pressure machines for aluminum castings . . . large plunger type machines for large zinc castings . . . automatic machines for small zinc castings (see left). Much of this equipment was designed by Dollin engineers. Send prints or samples for estimates. Engineering advice at no obligation. General Facilities Bulletin on request.

Dollin Corporation, 614 So. 21st St., Irvington, N. J.

DOLLIN Zinc and Aluminum **DIE-CASTINGS**

Sales Offices: Boston • Buffalo • Canton • Chicago • Detroit • Philadelphia • Pittsburgh • St. Louis • St. Paul

For additional information Circle No. 17 on the Reader Service Card

Fire-resistant PYDRAUL cuts hydraulic fluid hazards

Hydraulically operated machines, like the die-caster in the picture, are often prey to vicious fires that start with a leak in a pressure line. Flammable hydraulic fluid escapes and sprays onto hot metal, turning to liquid flame that can burn or maim personnel, destroy stock and buildings.

Monsanto now provides a simple, effective answer to this problem which has cost American industry millions of dollars a year. Safe, economical Pydraul, a nonflammable-type fluid, is currently employed in more than 100 plant applications—with notable success.

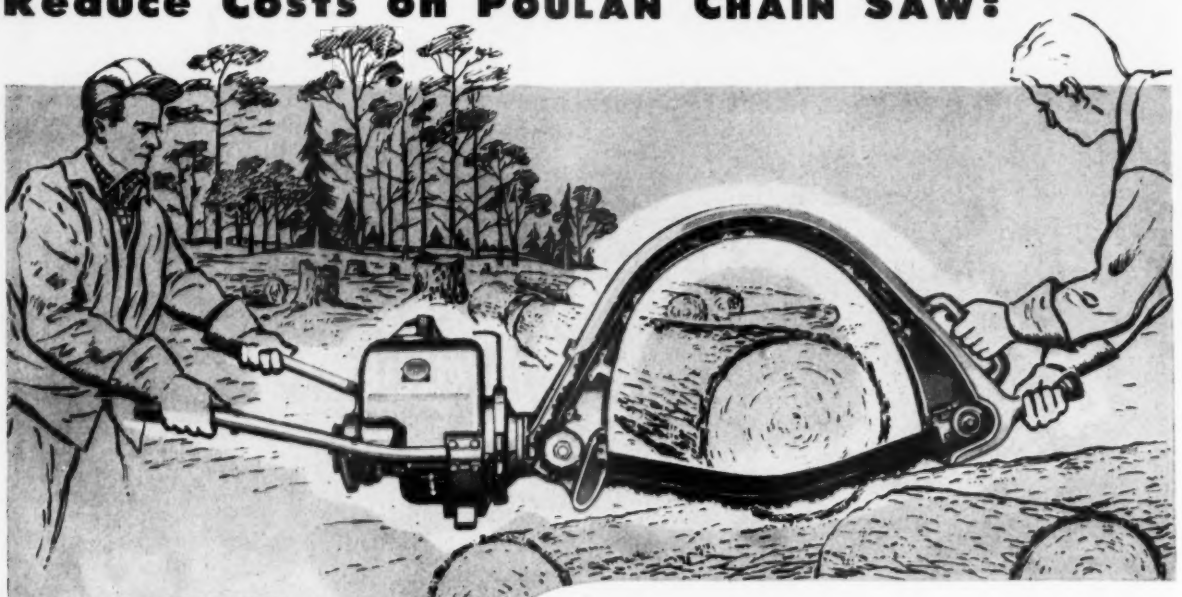
Pydraul, when test-poured on molten metal and sprayed into an oxyacetylene flame, does not flash or ignite. It has high lubricity and is noncorrosive to metal . . . nonvolatile and insoluble in water. Because it requires no special changes in equipment, Pydraul can be introduced into a hydraulic system simply by draining and refilling. **Pydraul: Reg. U. S. Pat. Off.*

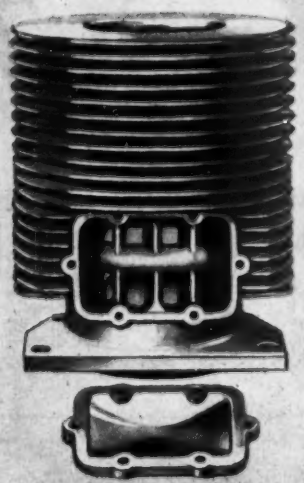
NO PYDRAUL HERE	PYDRAUL USED HERE
CASE No. 1 In a Southern steel tinning plant, a break in a hydraulic line released flammable spray that ignited oil. Fire loss: $925,000.	**CASE No. 3** When a hydraulic line parted, the fluid (Pydraul) sprayed into a hot zinc melting pot, splattered several employees. Result: no fire, no injuries, no production loss.
CASE No. 2 In a die-casting plant, rupture of a hydraulic line sprayed fluid over hot machines and gas-fired aluminum melting furnace. Loss: $340,000.	**CASE No. 4** On a new die-casting machine, a hydraulic leak caused by faulty union sprayed Pydraul over equipment and molten aluminum. Result: No fire, no damage.
Write today for "Pydraul F-9," an engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.	MONSANTO CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

For additional information Circle No. 28 on the Reader Service Card

Lightweight, Strong PARKER Die Castings Reduce Costs on POULAN CHAIN SAW!





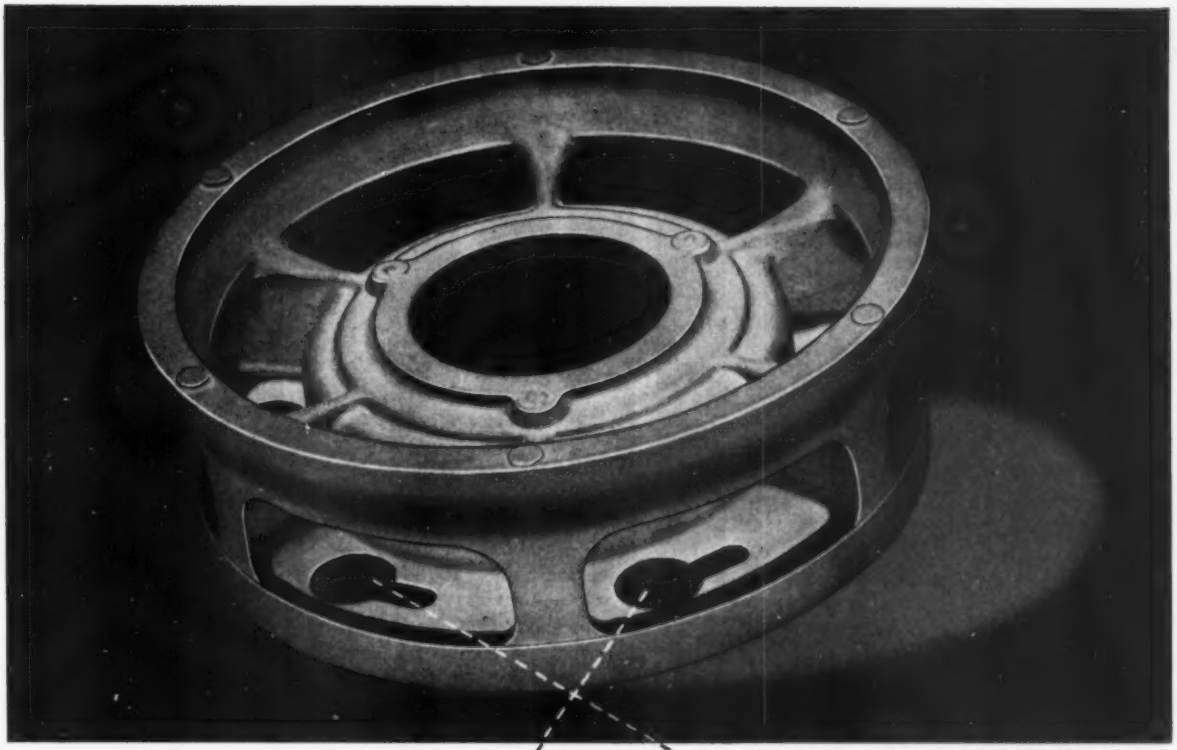
THE versatile, rugged Poulan Chain Saw is a boon to woodsmen everywhere. Its portability and ease of handling have made it a profitable piece of equipment to those engaged in the lumbering industry. Lightweight, strong die castings by Parker serve to lighten the load of the operator. The die cast engine cylinder and cover have helped reduce production costs since machining of the die cast part is eliminated. The die cast fins on the cylinder wall are strong and clean, diffusing heat evenly. This is another of the hundreds of instances where Parker Die Castings have lowered costs for manufacturers in nearly every industry. Parker Die Castings are lightweight, strong and clean. Machining is virtually eliminated. Consult with Parker on your next die casting requirements.

and when you think of Die Castings THINK OF

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM *and* ZINC *Die Castings*

For additional information Circle No. 30 on the Reader Service Card



*FROZEN MERCURY INVESTMENT CASTING

MERCAST* Buttonholes

BUTTON A GENERATOR on or off of an airplane? Westinghouse does! And at a reported time saving of up to 8 man-hours per plane!

The ingenious new Westinghouse generator mounting bracket employs "buttonholes" that permit the assembly to be quickly slipped on or off over headed studs on the airframe. For practical production of this unit, a one-piece precision casting to close dimensional and surface tolerances is the economical answer. This casting, however, is much larger than can be produced by ordinary investment casting processes.

Westinghouse brought the problem to Alloy Precision Castings Company. Engineers and metallurgists at Alloy developed the illustrated 6 lb., 6½ inch diameter mercasting in 410 stainless. Critical tolerances are held to ±.003"/inch. Very little finish machining is required and the "buttonholes" are used as cast. Complete inspection by Alloy assures customers top quality and accuracy.

Mercasting made the Westinghouse generator mount idea a reality. Send details about your "impossible" or "too costly" jobs today! Learn how Alloy Precision can save you time and money with designs for mercasting.

A-0296

ALLOY PRECISION CASTINGS COMPANY, DEPT. C-6
45th and Hamilton, Cleveland 14, Ohio

Please RUSH Bulletin 706 describing the Mercasting Process.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

ZONE _____ STATE _____

ALLOY PRECISION *Castings Company*

EAST 45th ST. AND HAMILTON AVE. • CLEVELAND 14, OHIO

For additional information Circle No. 2 on the Reader Service Card

SCHULTZ

Specialists in Zinc Die Casting

■ *YOU REQUIRE* die castings competitively priced which are dimensionallly accurate and superior in surface finish, delivered in time to meet your production requirements.

■ *WE FURNISH* zinc die castings of the highest quality delivered in accordance with shipping schedules at prices which are most attractive. For nearly a quarter of a century we have served many of the nation's leading manufacturers in this manner. May we also have the pleasure of serving you?

Exclusively Zinc Die Castings

SCHULTZ DIE CASTING COMPANY

1510 CLINTON STREET • TOLEDO 7, OHIO

For additional information Circle No. 35 on the Reader Service Card

SMALL IRON SAND CASTINGS . . . can be converted to the Precision Metal Molding Processes

THREE facts of interest to every designer, buyer and producer of metal components are particularly significant:

A major portion of the 399,600 tons of small iron castings poured each year are produced in quantities above 5,000 pieces.

The amount of machining required by the average sand casting, representing the largest part of finished piece costs, could be eliminated by one of the more precise molding methods.

Functional and physical characteristics are often attainable in a precision-type molding which would not be possible by sand casting.

To the designer and purchasing agent, no less than the fabricator, three factors studied in this survey will be of prime interest: How many duplicate parts are used per year? Who buys these small iron castings? How much does machining add to the piece cost?

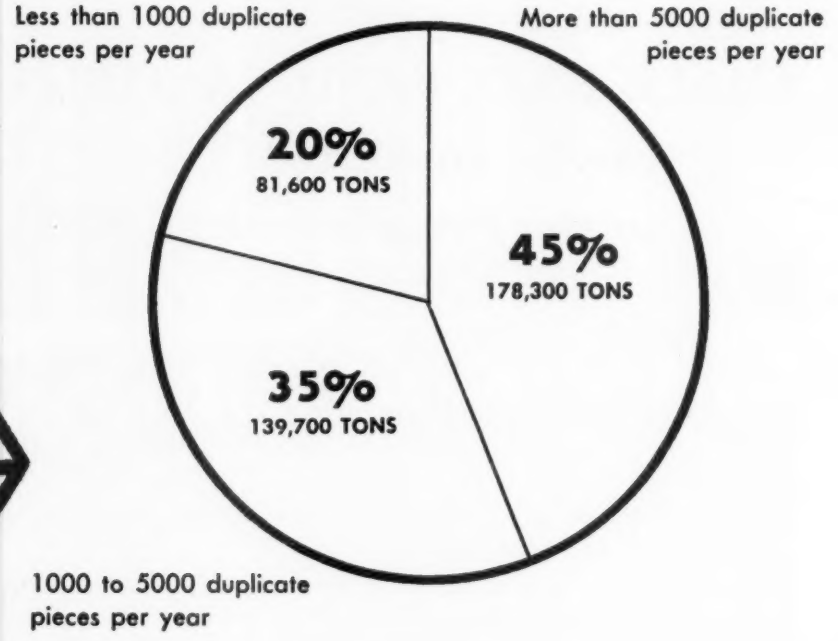
A SURVEY just completed by the market research department of PRECISION METAL MODELING magazine has revealed that close to 400,000 tons of grey and malleable iron castings weighing less than one pound apiece are poured each year . . . and a substantial part of this tonnage could be redesigned for production by one of the precision molding processes to gain lower cost, improved function of both . . .

A report on this survey is presented on the following pages . . .

SMALL CASTINGS ARE BIG BUSINESS . .

The average small iron sand casting is produced in large enough quantities to make a more precise type of fabrication economical.

A look at this analysis of small gray and malleable iron castings will show a big, new market for precision metal moldings.



How many duplicate parts are used per year?

Parts that are purchased in quantities of 5,000 pieces or more are most likely to lend themselves to redesign for production by one of the precision molding methods. When more than 5,000 pieces are scheduled, the write-off of tool costs is least likely to be a determining factor in choice of methods.

For this reason, it is interesting to note that the largest portion of the 399,600 tons of small iron castings falls within this range. *The survey reveals that about 45 percent of the total tonnage of small iron castings are produced in batches of at least 5,000 pieces.*

Next in size and importance are those castings produced in lots of from 1,000 to 5,000 pieces. This represents about 35 percent of the total, while only about 20 percent are cast in quantities of less than 1,000 pieces.

Who buys these small iron castings?

Some industry groups, such as the manufacturers of vending machines and communications equipment, are potentially large users of iron castings, but both of these industries have already converted so extensively to zinc and aluminum die castings that their tonnage of iron castings is negligible.

This type of conversion by industry groups shows what can be done when an industry becomes aware of the advantages of the more precise molding processes in its manufacturing. For this reason, it is well to ask, "Which industry groups buy these iron castings that total nearly 400,000 tons per year?"

In terms of percent of the total, farm machinery leads the field, followed in order by machine tools, general hardware, business machines, home appliances, transportation and electrical machinery. Lesser amounts are used by makers of steel mill machinery, com-

Many industry groups now buy small iron sand castings.

Because of high machining costs, a more precise type of fabrication may be more economical.

INDUSTRY GROUPS WHICH PURCHASE THESE CASTINGS

Industry group	Percent of total	Tons over 5000 pcs.	Tons between 1000 & 5000 pcs.	Tons under 1000 pcs.
Transportation	10.4	18,960	14,860	8680
Communications	1.03	1,836	1,440	840
Business machines	12.32	21,950	17,220	10050
General Hardware	15.67	27,930	21,900	12790
Machine Tools	15.82	28,200	22,200	12920
Home appliances	10.94	19,500	15,280	8930
Farm Machinery	20.59	36,670	28,750	16800
Vending Machines	0.04	72	56	43
Electrical Machinery	9.69	17,260	13,540	7910
Textile Machinery	0.24	428	335	196
Steel Mill Machinery	2.37	4,230	3,310	1939
Mining Machinery	0.63	1,120	880	514

INCREASE IN COST DUE TO MACHINING

Industry group	Minimum percent	Maximum percent	RMS Av. percent
Transportation	22	150	90
Business Machines	100	127	113
General Hardware	5	55	50
Machine Tools	20	500	244
Home Appliances	50	50	50
Farm Machinery	5	350	213
Electrical Machinery	20	1200	166
Misc. Machinery	250	400	323
All industries			156

munications equipment, mining machinery, textile machinery and vending machines.

How much does machining add to the piece cost?

Despite normally low piece costs for sand cast iron, the need for numerous machining operations and other secondary processing very often pushes the price of the finished casting beyond reasonable limits. Where secondary costs are out of line on a sand casting, it becomes an economic necessity to go to one of the precision molding processes to cut costs of finished pieces.

Since this is probably the greatest single determinant in the decision to switch from a rough sand casting to an accurately-dimensioned precision process, the editors of PMM have surveyed the appreciation of value due to machining.

It should be noted that the increase in cost indicated in Figure 3, represents *only machining*, since it was not feasible to include in this survey other factors such as heat treating, polishing, inspection, rejects, surface finishing and other items that affect finished costs. It is likely that these other operations will average higher in cost than the machining, and these can, likewise, frequently be eliminated or reduced by change to one of the precision molding techniques.

The amount of machining done on the average casting included in the survey increased the cost of the piece by 156 percent, which indicates that a substantial number of pieces have machining which multiplies their cost by four or five times. In one industrial group, it was indicated that costs climbed 1200 percent in machining.

Unfortunately, some of the groups surveyed could not give the desired information on machining, so that the survey has been limited to those groups giving information full and detailed enough to be considered reliable. No

continued next page

figures were available from the communications industry, and it was necessary to lump as miscellaneous machinery, the vending, textile, steel mill and mining machinery groups.

What does this survey mean to designers of metal parts?

Grey or malleable iron castings are used primarily because they have low unit cost. Even though considerable amount of machining may have to be done on the casting, the low first cost has largely been influential in the use of sand cast iron.

All too often, this lower cost is a mirage which vanishes when secondary costs are appended. The survey reveals that *there is a substantial group of small iron castings whose size, weight, quantity and secondary operations make them work examining for redesign as sinterings, die castings, permanent mold castings, investment castings or plaster mold castings.* In each instance, function, quantity and shape will indicate which process is most suitable.

Such profitable redesign can only be detected by studying individual pieces; this survey simply outlines those broad areas where conversion to a precision type of molding is most likely to exist.

Submitted here is a check list which the designer can utilize in weighing the costs and advantages of various castings now in use. It is intended to help in pointing out those iron castings which should be given individual study for possible conversion.

For example, if the answer to more than one of the items in the check list is "Yes," there is a strong likelihood that a reexamination of this part would indicate a lower-cost, higher-precision fabricating method. The quantities indicated in answer to the first question would also be weighed in this review.

Furthermore, the editors have gathered a number of specific examples of each precision molding method which has replaced a sand casting for reasons suggested in the check list. This group of redesigned castings and sinterings could be multiplied many times from current production, but limits of space preclude the showing of any others.

Are your small Iron Castings really less expensive? Check them against this list to find out . . .

1. **How many duplicate castings are required per year?** ------
2. **Are these castings machined after being received?** ------
3. **If machined, is the value of the castings increased by more than 100 percent?** ------
4. **Is a surface finishing treatment required to prevent rust?** ------
5. **Do casting defects, blowholes opened by machining or other flaws cause moderately high rate of rejects?** ------
6. **Would a more complex or different shape be desirable if it could be obtained at reasonable cost?** ------
7. **Is adequate lubrication a problem?** ------
8. **Would it be desirable to reduce the weight without substantially changing the size?** ------
9. **Is your present machine tool capacity overloaded?** ------
10. **Do multiple inspections appreciable increase finished costs of iron castings?** ------

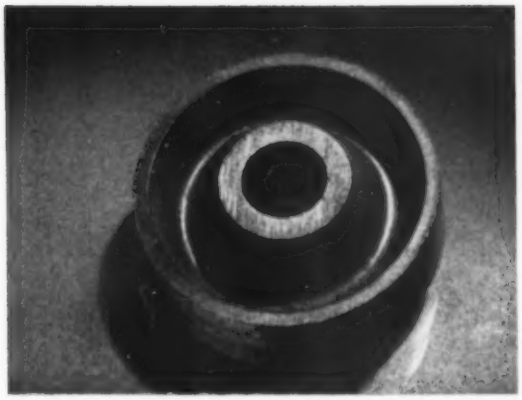
How was the survey made?

A questionaire was sent to 437 grey iron and malleable iron foundries scattered over the entire United States. Each foundry was asked to give its annual tonnage poured; the percentage of the total tonnage that weigh less than one pound; the percentage of small (one pound or less) castings made in quantities of more than 5000 per year, 1000 to 5000 per year, and less than 1000 per year. In addition, each foundry was asked to indicate the percentage of their small castings purchased by each of several listed industry groups.

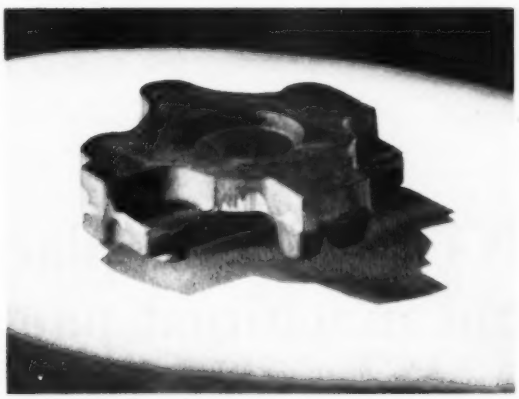
A large percentage of those questioned responded so that it was possible to project the findings to the entire iron foundry industry of the country. As a basis for projection, the figures of the Department of Commerce, Bureau of Census were used. The latest complete figures are those for 1947 which were used with no attempt to correct them to a 1952 level. The most serious error that the use of these figures should introduce is to put the tonnage figures to be given on the low side, thus making the survey results

Take your choice: Sand cast iron or . . .

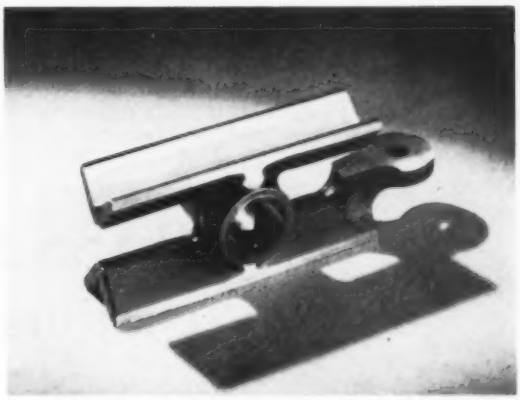
DIE CAST ZINC gives better distribution of mass at lower cost for this sewing machine hand wheel. See PMM July 1952, p 33.



IRON SINTERING gives superior performance at lower cost for this textile machine component. See PMM Aug. 1952, p 29.



PERMANENT MOLD CASTING in grey iron gives greater strength than sand cast machine tool part. See PMM Jan. 1952, p 26.



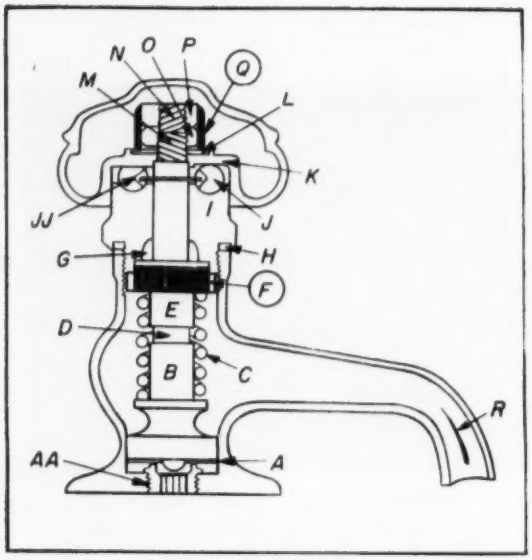
INVESTMENT CAST crosshead for a cloth cutter cuts costs by 40 percent over sand casting. See PMM Mar. 1952, p 42.

somewhat more conservative than is necessary. (Note: The change in general industry index given by the Labor Dept. is from 99.5 percent in 1947 to 103 percent in 1952).

Based upon the size of the sample and the number of replies that were received the indicated accuracy of the results is within ± 10 percent.

A second questionaire was sent to representative companies in each industry group asking them to give the *average* percentage by which the cost of an iron casting was increased by machining. In every case this was machine work done on the castings after they were received from the foundry and does not include either work done prior to receipt nor does it include finishing costs such as painting, lacquering, plating, etc. Nor does it include cleaning preparatory to finishing.

This latter item of finishing (and preparation for finishing) can easily represent another appreciable saving which can not be broadly evaluated since it will vary largely depending upon the process and the metal chosen to replace the iron casting.



1. TWO BRASS SINTERINGS (Q and F) are indicated in this view of a self-closing faucet.

Because they have always used sand cast or machined brass parts, many designers of plumbing fixtures have not yet recognized the potentialities of powder metallurgy as a fabricating method.

Brass sinterings are now replacing many parts formerly cast, extruded or machined from bar stock . . . at a marked reduction in cost. Scores of applications are yet to be recognized as sound uses for sinterings in the plumbing field.

The editors of PMM present here typical applications of brass sinterings in plumbers' goods which have replaced other types of parts. It is hoped that these will suggest similar applications to the designer.

BRASS SINTERINGS replace extrusions and machined parts

By P. R. KALISCHER
Associate Editor

ONE of the most promising fields to which powder metallurgy can look for new markets is plumbing brass where large numbers of parts are now machined from wrought stock or sand castings.

Substitution can only be made, of course, where adequate physicals can be secured from a sintering at a competitive cost. In many cases, the older method of fabrication is used simply because it is the way it has always been done, due largely to lack of knowledge about brass sinterings on the part of the manufacturer of plumbing goods.

There has been some belief that powder metallurgy cannot compete with either extrusions or screw machine operations, but in the light of the experience of the Central Brass Co., of Cleveland, Ohio, it is of interest to examine this line of thinking.

The section drawing of the self-closing faucet in Figure 1 shows the application of

two brass sinterings, parts "F" and "Q". Each of these parts is worth considering separately.

Sintering vs extrusion and screw machine

Functionally, this part is designed to prevent turning of the valve stem and to prevent subsequent grinding of the seat washer on the seat. As can be seen from Figure 2 and the drawing of the part in Figure 3, the prongs of the gland must take the entire torque developed when the handle of the faucet is turned. This same torque must be carried by the "flat" in the bore. This type of service is generally not recommended for a sintering.

As originally designed, the gland was machined from extruded brass stock. The noncircular hole and the prongs were shaped in the extrusion, but the balance of the shaping had to be done on a screw machine. Further, the extruded hole was not sufficiently accurate as received and was broached.

When conversion was made to a sintering, it was possible to make a finished piece ready to install in the faucet. All dimensions are held to ±0.002 by the fabricator, the American Sintered Alloys Div. of Yale & Towne Mfg. Co. in Bethel, Conn.

The manufacturing process formerly used was about as inexpensive as it is possible to achieve when any machining at all must be done. In spite of this, however, the sintering replaced the machined extrusion at a cost reduction of 3.1c per piece (a saving of about 40 percent).

An even more outstanding example of conversion is the geared sleeve shown in Figures 4 and 5. As in the case of the gland, this part was originally a brass extrusion. Final machining required only a cutoff operation. In spite of this low-cost operation, powder metallurgy has been made able to reduce the piece cost by 0.55c (about 20 percent).

Dimensional tolerances on this sleeve are more open than on the gland, as can be seen from the drawing.

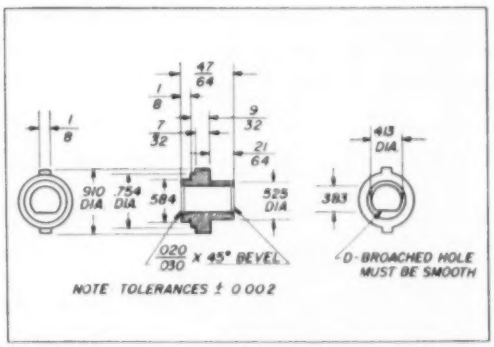
Since this sleeve functions as a locking device to prevent the two nuts "O" and "P" from loosening, the two teeth which fit into matching grooves on the nuts must be sufficiently strong to prevent any turning and must not deform or the adjustment feature of the faucet handle would be lost. Physically, the sintering is adequate in every respect.

Fast delivery and lightened inspection — two advantages

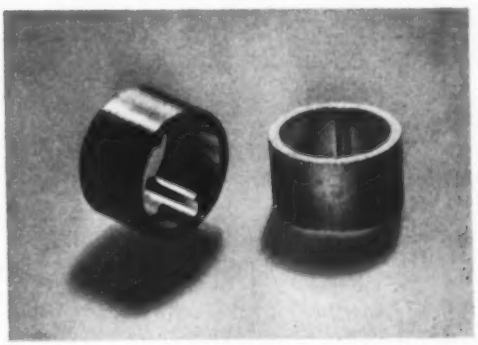
There are certain other aspects of this conversion that are not immediately apparent, but which are of great importance. Consider the matter of deliveries first.

continued on page 127

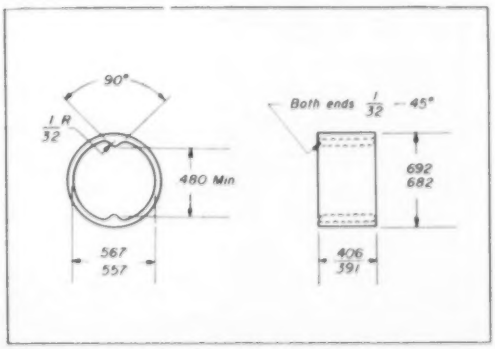
2. ORIGINALLY an extrusion, this brass gland is now made as a sintering at lower piece cost.



3. NORMAL TOLERANCE on this piece is indicated on the drawing calling for ± .002.



4. ONLY A CUT-OFF was needed when this was extruded, but a saving of 20 percent has been realized by change to a sintering.



5. TOLERANCES on the geared sleeve are somewhat more open than on the gland.

Ninth Annual Meeting of the METAL POWDER ASSOCIATION

BIG event of the year in the field of powder metallurgy is the Ninth Annual Meeting of the Metal Powder Association being held in Cleveland this year. The meetings, and the trade show held in connection with it, will convene at the Hotel Cleveland on April 21 and 22.

Program of the meetings and a list of exhibitors is presented on these pages. Last year's attendance reached the 600 mark and is expected to surpass that figure in 1953.

Papers to be delivered at the two-day sessions will cover a full range of interests of buyers, designers and producers of sinterings. They will hear important discussions of high density parts produced from iron powder; production, uses and processing of aluminum powders; and developments in clutch plate applications for metal powder friction materials.

They will hear reports on the iron powder situation and will get an insight into advantages and disadvantages of using brass powders. Properties obtainable by using alloy powders produced by the Hydride process will be pointed out.

In the electronics field, they will get full reports on the N. B. S. permeameter, and will be brought up-to-date on design trends in iron coil components for electronic equipment.

The use of a non-metallic impregnant for sealing sinterings will be the subject of another technical discussion where pressure tightness and

LIST OF M. P. A. SHOW EXHIBITORS

BOOTH	EXHIBITOR
1	Kux Machine Company
2	Metal Hydrides Inc.
3	Machine Design Magazine
4	Electric Furnace Company
5-7	F. J. Stokes Machine Company
8	Antara Chemicals Division, General Dyestuff Corp.
9	Amplex Mfg. Co., subsidiary Chrysler Corp.
10	Arthur Colton Company
11	Magnetic Powders Inc.
12	Metals Disintegrating Company, Inc.
13	Lindberg Engineering Company
14	Ekstrand & Tholand, Inc.
15	Raybestos Division, Raybestos - Manhattan, Inc.
16	Charles Hardy, Inc.
17	Harper Electric Furnace Corporation
18	Glidden Company, Chemicals-Pigments Metals Division
19	Plastic Metals Division, National Radiator Company
20	Federal-Mogul Corporation
21-22	Easton Metal Powder Company, Inc.
23	Vanadium - Alloys Steel Company
24	New Jersey Zinc Company
25	American Sintered Alloys Division, Yale & Towne Manufacturing Company
27	Powdered Metal Products Corporation of America
28	American Metaseal Mfg. Co.
29	Brush Laboratories Co.
30	Powdercraft Corporation
31	Materials & Methods Magazine
33	Johnson Bronze Co.
35	Precision Metal Molding Magazine

B. A. Gruber

J. Haertlein

J. F. Sachse

finishing of sinterings will be reviewed.

Exhibiting at the show will be manufacturers of sinterings, producers of metal powders, builders of equipment for powder metallurgy, and trade publications.

Program of Meetings

Tuesday morning, April 21

The Processing in the Higher Density Range of Durable Precision Iron Powder Parts on a Production Basis.

W. J. Doelker and H. T. Harrison, National Cash Register Co.

A Progress Report on the N.B.S. Permeameter

G. P. McKnight, Speer Resistor Div., Speer Carbon Co.

Design Trends in Iron Core Coils

Bernard Goldsmith, Essex Electronics.

Tuesday afternoon, April 21

Metal Powder Friction Materials in Heavy Duty Transmissions

J. E. Storer, Allison Div., General Motors Corp.

A Survey of the Iron Powder Situation

R. L. Ziegfield, Metal Powder Association

Alloy Powders by the Hydride Process

B. A. Gruber, Metal Hydrides, Inc.

A Progress Report on Brass

D. C. Bradley, New Jersey Zinc Co; and W. R. Toeplitz, Bound Brook Oil-Less Bearing Co.

Wednesday morning, April 22

The Non-Metallic Impregnation of Sinterings

W. N. Pratt, American Metaseal Manufacturing Corp.

Review of Aluminum Powder Metallurgy

J. Haertlein and J. F. Sachse, Metals Disintegrating Co., Inc.

Powder Metallurgy at the Cross Roads—Present and Future Possibilities

J. D. Shaw, S-K-C Research Associates

The Current Outlook for Metals (Luncheon address)

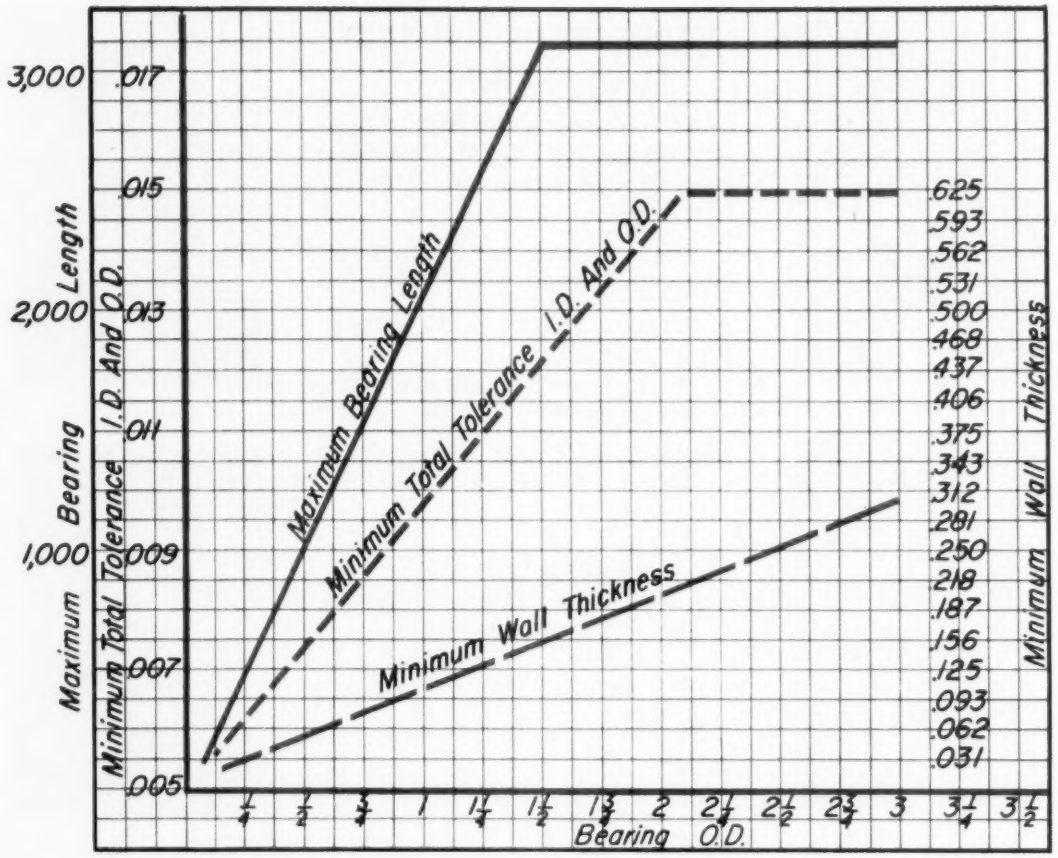
Dr. Joseph Zimmerman, Daily Metal Reporter

W. T. Doelker

H. T. Harrison

G. P. McKnight

D. C. Bradley



1. FOR THE DESIGNER who does not need close tolerances on his sintered iron bearings, this chart gives maximum bearing length, minimum total tolerance on ID and OD, and minimum wall thickness for any OD.

Tolerance control of SINTERINGS for cost control

By RICHARD B. THOMSON*

THERE is a logical way to design sinterings to fit your budget. The first step is to determine, just what quality level you are striving for. Sintered parts offer more for the money than the same type parts made in other ways, and like the other processes, the more precision you require, the more the cost. For instance, if all that is wanted are the basic advantages of self lubrication and low cost, then specify wide enough tolerances so that only the briquetting and furnacing operations are necessary. There are three operations (briquetting, sintering and coining) in producing sintered parts. If coining is eliminated you stand to save as much as 33 percent of the same part incorporating close limits. On the other hand, a precision part can be obtained by including the coining operation and you will find the piece price at this quality level to be very reasonable.

Tolerances can control cost, but even more important is the need for understanding the

*Sales Engineer, The United States Graphite Co., Div. of The Wickes Corp., Saginaw, Mich.

various factors in the process which have a definite effect on tolerances. Knowing the various steps used for the manufacture of sintered parts, you can determine the price level yourself before contacting a sintered metal fabricator.

Factors affecting tolerance control

Many factors have to be considered when studying tolerance control. The major factors are:

- part design,
- material,
- equipment, and
- the number of operations planned.

In a sense, part design and material can be considered at the same time. This is because the molding possibilities of both design and material have to be studied to determine the tolerance range. As an example, sintered iron compacts tend to have better dimensional stability as a result of sintering than non-ferrous compacts. This means that for minimum costs and consequently, only the two basic operations, (briquetting and sintering) you should plan on using an iron sintering. In addition, you must always think in terms of variable densities. The varying densities resulting from a part having counterbores, steps, or shoulders cause size distortion in sintering; at least they cause more than normal distortion.

We are saying, in effect, that a sintered iron part, designed as simply as possible, can be held to much closer limits without the necessity for the coining operation. It is normal to expect to include the coining operation with non-ferrous compacts, because of distortion from sintering. As a result of utilizing the third operation, closer limits are more common with non-ferrous than with the ferrous pieces.

In this run-down on the factors which will affect tolerance control, it might be well to study the equipment factor. Generally speaking, length and thickness tolerances cannot be held as closely as other dimensions. This is a direct result of the manner in which parts are briquetted and coined. The reciprocal motion of the presses is brought about by a series of arms and rams mechanically connected by means of moving joints, bushings, and rollers. Any flexibility in the material making up the arms and rams causes a variation in the thickness of the part being pressed. Also, the resiliency of a given briquette, the moment after compacting, causes springback and this also causes size variations.

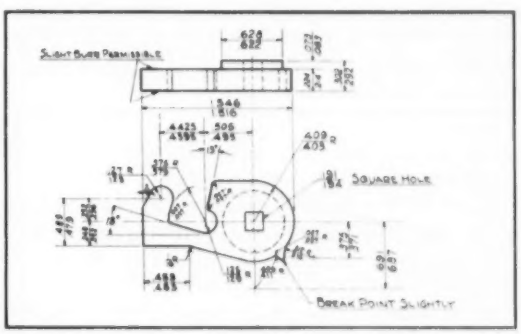
Tolerance figures for the basic operations

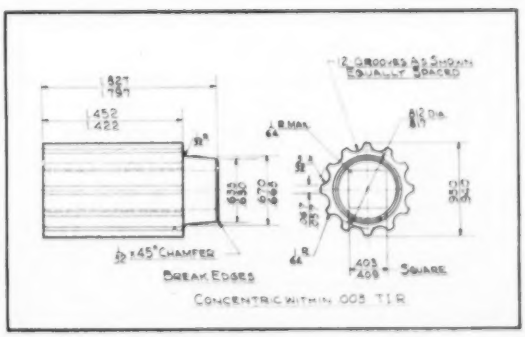
We mentioned before that non-ferrous sinterings are usually associated with the extra coining operation. As a practical approach then, we will only consider the ferrous grades in connection with the two basic operations.

The graph in Figure 1 can be used as a guide for designing sintered iron bushings at minimum costs. The curves will show maximum bearing length, minimum total tolerance, and minimum wall thickness for a

continued next page

2. TWO SINTERINGS illustrate tolerances on parts that are only to be briquetted and sintered. Part "A" (top) is a sintered iron lock ratchet, while part "B" (below) is a seed roll. These tolerances allow minimum costs and both parts have proved superior in performance to their solid steel counterparts.





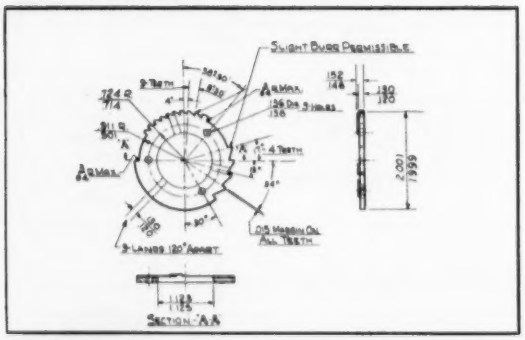
Commercial Tolerances for Iron* and Bronze Sintered Bearings

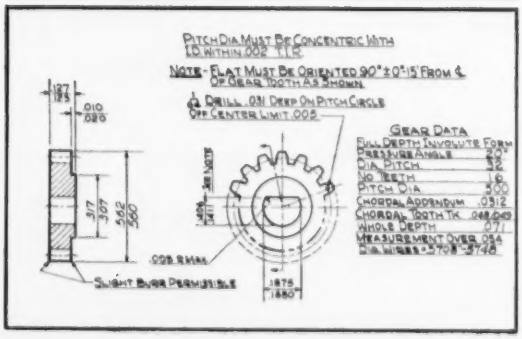
Style of Bearing	Dimension	Diameter of Bearing	Tolerance
Plain & Flange (Bronze)	ID and OD	up to 1½" (inside)	.001"
		1½ to 2½" incl. (inside)	.0015"
		over 2½" (inside)	.002"
	Length	up to 1½" (inside)	.010"
		1½ to 3" incl. (inside)	.015"
		over 3" (inside)	.020"
Plain (Bronze)	Wall Thickness	up to 1" (inside)	.062"
		1 to 2" incl. (inside)	.093"
		2 to 3" incl. (inside)	.123"
		over 3" (inside)	.186"
Plain & Flange (Iron)	ID and OD	up to ⅝" (inside)	.001"
		⅝ to 2" incl. (inside)	.002"
		2 to 3¼" incl. (inside)	.003"
	Length	up to 1½" (inside)	.010"
		1½ to 3" incl. (inside)	.015"
Plain (Iron)	Wall Thickness	up to 1" (inside)	.062"
		1 to 2¼" incl. (inside)	.125"
		2¼ to 3" incl. (inside)	.186"

*Includes Iron or Iron Copper Alloy, Copper not to exceed 20%.

3. QUICK REFERENCE for tolerance specifications on precision, sintered bearings in both iron and bronze, is furnished in the chart, above.

4. PARKING METER RATCHET, top, is a bronze sintering with close tolerance on ID and OD as well as on the three small holes. Extra coining operation ensures consistent quality and excellent wear surfaces. SINTERED IRON GEAR, bottom, is coined for especially close tolerance specifications.




PITCH DIA MUST BE CONCENTRIC WITH I.D. WITHIN .002 T.I.R.
NOTE - FLAT MUST BE ORIENTED 90° ± 0°15' FROM ℄ OF GEAR TOOTH AS SHOWN
DRILL .031 DEEP ON PITCH CIRCLE OFF CENTER LIMIT .005
GEAR DATA
FULL DEPTH INVOLUTE FORM
PRESSURE ANGLE 20°
DIA. PITCH 32
NO. TEETH 60
PITCH DIA. .500
CHORDAL ADDENDUM .0312
CHORDAL TOOTH TH. .049/.049
WHOLE DEPTH .071
MEASUREMENT OVER .054 DIA. WIRES .5708 - .5740
SLIGHT BURR PERMISSIBLE

given OD bearing. These bearing tolerances are based on the fact that there will be only two operations — briquetting and sintering — for making the bearing.

For example, if we have a bearing with an OD of 1 inch we can see by checking on the appropriate curve that it cannot be any longer than 2 1/16 inch. Also, the minimum wall thickness would be 7/64 inch and the minimum total tolerance on both ID and OD would be approximately .010. It will be noted that we have not extended the bearing lengths past 3⅛ inch. When this length is exceeded certain operational or physical property difficulties might be encountered, and it would be best to discuss this type dimensional problem with a manufacturer of sinterings. This graph should be of real help to those who are not certain whether or not their diameter tolerances or wall thicknesses will allow the parts to fall into the proper quality level.

There are still other parts to consider in the category of pieces not coined. These are the parts used as ratchets, cams, gears, and other types of machine pieces. The application or function of these parts will determine, of course, how broad the tolerances can be. If we assume that the tolerances on parts of these designs are not critical, then we can design and dimension so as to eliminate the coining operation.

It is almost impossible to give a rule of the thumb on the limits which can be specified for various dimensions on these parts. Variable section thicknesses along with shoulders,

continued on page 123

Current Research in POWDER METALLURGY

- Porous stainless steel
- Liquid phase sintering
- Soft and permanent magnets
- Unalloyed aluminum powder
- Iron powder metallurgy
- Improved cermets
- Replacement of cobalt in cemented carbides

RENSSELAER POLYTECHNIC INSTITUTE

F. V. Lenel

THE Department of Metallurgical Engineering of Rensselaer Polytechnic Institute has a Powder Metallurgy Laboratory which is directed by Dr. Fritz V. Lenel, associate professor at the Institute. The laboratory is used both for teaching and for developmet and research work. At present, work is under way on five projects, which are sponsored by the Armed Forces and by private industry.

• The use of porous stainless steel for transpiration cooling has been investigated for the last three years. In the first part of this project the relationship between the room and elevated temperature strength properties and their permeability for the cooling medium were determined.[1] At present the investigation is concerned with specific engineering problems in the design and production of transpiration cooled components.

• The problem of substituting less critical metals or alloys for cobalt as a binder metal in cemented carbides tool materials is being studied from various angles. One line of investigation is to determine the solubilities of tungsten carbide in various metals and alloys and their temperature dependence in order to obtain a clearer picture of the action of the binder metal in cemented carbides.

• A fundamental study of the mechanism of liquid phase sintering has been under way in the powder metallurgy laboratory for the past four years. A large number of systems has been studied with regard to rates of densification and changes in microstructure and mechanical properties, and a tentative theory of the various stages in liquid phase sintering has been developed?[2] Additional experimental data are being collected to make the theory more quantitative.

• A material made from unalloyed aluminum powder having a room temperature strength in the range of age-hardened aluminum alloys and strength properties at elevated temperatures up to 900F not equalled by any known aluminum base material has been developed in Switzerland under the trade name SAP. A project in which the reasons why this material has such unusual properties are to be studied has just been initiated in the powder metallurgy laboratory.

• Another investigation which has just begun is concerned with iron powder metallurgy. Iron powder compacts pressed and sintered to the same density under the same sintering conditions have been found to vary considerably in mechanical properties. The reasons for these variations are to be studied. As a first approach, powders varying in specific surface, but being otherwise as nearly identical as possible are to be produced, compacts are to be pressed and sintered from these powders, and the specific surface of the powders and the mechanical properties of the compacts are to be correlated.

[1] Porous Stainless Steel Compacts for Transpiration Cooling by F. V. Lenel and O. W. Reen, presented at 1952 Symposium on Methods of Testing Metal Powders and Metal Powder Products, Special Technical Publication of the Am. Soc. for Testing Materials in press.

[2] H. S. Cannon and F. V. Lenel, Some Observations on the Mechanism of Liquid Phase Sintering, Proceedings of the Plansee Seminar, Reutte, Austria, in press.

LEHIGH UNIVERSITY

Joseph F. Libsch

RESEARCH in powder metallurgy at Lehigh University is devoted primarily to the preparation of magnetic materials. These include both soft

magnet and permanent magnet materials.

The soft magnetic materials include pure iron, binary alloys of iron with cobalt, nickel, silicon, phosphorus and arsenic, and a large number of ternary alloys. The alloys are normally prepared from the elemental powders, including carbonyl or electrolytic iron, reduced cobalt, etc. Occasionally, elements are added, as ferro-alloys or other compounds.

High density and extreme purity are paramount for good magnetic properties. Long sintering cycles at temperatures close to the melting temperature are therefore, necessary. Such treatments develop densities typical of the fused material and magnetic properties which compare favorably with cast and wrought materials.

Powder metallurgy preparation of permanent magnet materials includes ternary alloys of iron, cobalt and vanadium, frequently with fourth element additions. Long sintering cycles at elevated temperature have not developed maximum density in these alloys and hot-working of sintered compacts has been necessary to develop high density and magnetic properties typical of the cast and wrought materials.

Powder metallurgy methods have also been used to prepare compacts of ultra-fine ferromagnetic powders, i. e., iron, exhibiting permanent magnet characteristics. Since these powders are pyrophoric as prepared, pressing as a liquid slurry is required. Theoretically, an attempt is being made to use the relatively sharp decrease in coercive force caused by sintering of the fine powders as a criterion of the initial stages of the sintering process. The sintering temperature at which the sharp decrease occurs depends upon a number of sintering variables, including impurities and sintering time.

This work is sponsored primarily by the U. S. Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, and by the Office of Naval Research, Physics Branch, Washington, D. C.

REFERENCE

(1) **"Effect of Annealing in a Magnetic Field Upon Iron-Cobalt and Iron-Cobalt-Nickel Alloys Prepared by Powder Metallurgy", by Libsch, Both als., Trans. AIME, Vol. 188, Feb. 1950, pp. 287.**

(2) **"Development of Mechanical and Magnetic Hardness in a 10% Vanadium-Cobalt-Iron Alloy" by R. W. Fountain and J. F. Libsch. To be published by AIME Transactions. (Journ. of Metals, Jan. or Feb. 1953).**

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Amos J. Schaler

WE are not doing much work in powder metallurgy now except in the field of cermets, and none of what we are doing is classified (secrecy and teaching are mutually exclusive).

The cermet program has its aim to analyse the processing operations to determine where improvements can lead to a better product, without necessarily considering whether these improvements are feasible in a production plant. In particular, we have been working with TiC - base cermets because they are among the most sensitive to processing errors. In straight TiC-Ni cermets we have been able to reach reproducible bending strengths near 300,000 psi at room temperature by paying careful attention to the following factors.

- First, all variables are controlled from the beginning, so we select TiC and Ni powders that are not necessarily the best, but that are constant in chemical composition, size, shape and size distribution.
- Next, we have found it best to give the powders a heat treatment in a known (hydrogen) carefully purified atmosphere.
- Then the powders are ball-milled, under careful control, in a medium found best in this case by experiment: carbon tetrachloride.
- The milled suspension is centrifuged but not dried, then within a known and short time the paste is syringed into a precision die, pressed from both sides, and immediately sintered in high vacuo by induction.

In heating up, the residual gas pressure is maintained at a fixed low value, so that by the time the sintering temperature is reached degassing is complete. The compacts rest on a material found best by experiment, for almost all refractories can cause contamination.

The sintering temperature was found by first completing an auxiliary study of the ternary Ti-C-Ni constitution diagram. The important parts of the diagram, which we emphasized, were the nickel-rich end (binder compositions) and the regions on both side of the TiC-Ni pseudobinary (for carbon-deficient and carbon-rich TiC).

The time of sintering is now under study, as is the metallographic structure which has the best properties. An auxiliary study bears on the last point: we are investigating the mechanical function of the binder film and of the binder-carbide interface to guide us in selecting the best microstructure.

Finally, now that we can reliably reproduce specimens of high strength, we have begun a study of the function of alloying elements in the binder (chromium, vanadium, etc.)

Each step in the study outlined, many of which are completed, has led to new ideas for further investigation, and in some cases a few preliminary experiments have been done to test the value of further study. Among these studies, which

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INVESTMENT CASTERS meet to set up new industry organization

THE need for an organization of investment casters has been expressed by many companies in the industry, and initial steps have been undertaken to set up such an organization, as reported in PMM (Feb 1953, p 45). Further developments toward the establishment of such a group are reported here.

Among stated objectives being tentatively considered for such an organization are the following items:

- Standardizing nomenclature, specifications and testing procedures within the industry.
- Acting in behalf of the industry in its relations with the government, and circulating the membership with bulletins clarifying government policies pertinent to the industry.
- Collecting and publishing statistics and other information which the membership may consider useful.
- Providing a forum for the voluntary exchange of information and problems within the industry, and establishing a liaison between manufacturers, vendors, and technical societies associated with investment castings, towards the promotion of better working conditions and higher efficiencies.
- Accelerating the growth of the industry by study and publication of the attributes of investment casting.
- Doing anything necessary to accomplish these objectives or otherwise improving the industry, continually conducting itself in accord with the public interest and relevant laws.

CONSTITUTION of a new Investment Casting Institute will be considered by representatives of the industry at a meeting taking place in New York April 6. This follows action in January and February during which preliminary discussions were held, a proposed constitution drawn up, and problems relating to the formation of such an organization were debated.

With 48 representatives of 29 commercial producers, and three vendor companies attending, the group convened in New York February 27 to weigh proposals drawn up by an organizing committee set up at the earlier session.

The committee, headed by Kenneth M. Bartlett, division manager of the Metallurgical Products Division of Thompson Products, Inc., Cleveland, had studied possible types of associations and societies that would fall within the framework indicated by the industry and also within federal laws governing such organizations.

Members of the committee, including T. Operhall, Misco Precision Casting Co.; S. J. Sindeband, Mercast Corp.; R. Waindle, Cannon-Muskegon Co.; E. B. Rogers, Adapti Co.; and K. J. Yonker, Howard Foundry Co., assisted by Meacham Hitchcock of Thompson Products, recommended the formation of an Investment Casting Institute.

At the February meeting, the tentative constitution was discussed and changes recommended. Final draft of the constitution is being weighed at the April session.

Under the proposed constitution, membership in the Institute will be limited to those companies actively engaged in the casting and sale of parts by the investment casting process. Limited membership will also be provided for vendor companies serving the industry, and to other outside organizations having a legitimate interest in the industry.

ACTING CHAIRMAN

Kenneth M. Bartlett

For purposes of the organization, "investment casting" was defined as the production of industrial metal castings made with expendable patterns and monolithic molds.

LARGE SIZE, high accuracy and some unique metallurgical advantages are achieved by casting aluminum alloy in molds made of sand and gypsum cement. Here is a review of casting size, surface finish, dimensional accuracy, metallurgical quality and other characteristics of this process.

The ANTIOCH PROCESS: for extra-large aluminum castings with close dimensional control

IN the casting of non-ferrous metals and alloys, the standard sand mold leaves much to be desired in the way of accuracy, surface finish and metallurgical quality in the finished casting. Some of these shortcomings are overcome by the plaster mold casting process but it, in turn, is limited to the production of relatively small castings.

There existed, therefore, a vacuum which no casting process filled — a method of casting large non-ferrous pieces to close dimensional tolerances, with a good finish and in almost any size.

About 1936 a process was developed at Antioch College that combined features of both sand and plaster mold castings*. In the

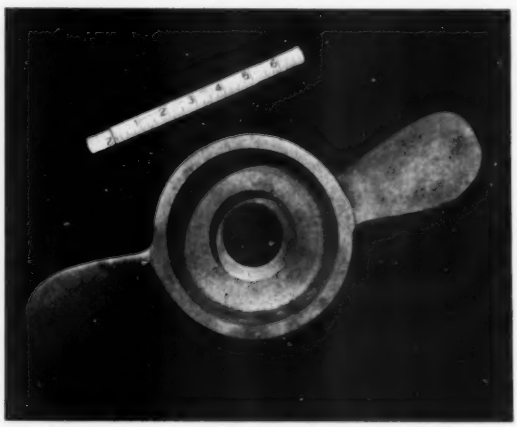
Large one-piece diffuser. Blade thickness and contour held to extremely close tolerances. Thick inside ring section is cast solid. Outside diameter held to plus or minus .030" Casting is porosity free for machined surfaces.

SPECIFICATIONS

Weight	340 lbs.
Diameter	5½ ft.
Alloy	Alcoa 214
Surface as cast	Better than 125 micro in.

Mechanical Properties (Separately cast test bars)

	Minimum	Typical
Tensile	22,000	24,000
Yield		12,000
Elongation	6%	7%
Brinell		50



Propeller for underwater missile. Cast to extremely close tolerance, this part must have outstanding metallurgical quality, smooth surface and closely controlled blade contours and dimensions.

SPECIFICATIONS

Weight	7 lbs.
Length	15 inches
Alloy	Alcoa 220T4
Surface as cast	Better than 64 micro in.

Mechanical Properties (Separately cast test bars)

	Minimum	Typical
Tensile	46,000	53,000
Yield	25,000	30,000
Elongation	14%	18%
Brinell	—	75

Mold for off-the-road tire. Tread surface of this one-piece aluminum alloy casting is used as cast. The 8 ft. diameter is held to tolerance of plus or minus .050 checked with inside micrometer. In addition, the casting is required to be free of surface and sub surface porosity.

SPECIFICATIONS

Weight	1,000 lbs.
Diameter	96 inches
Alloy	Alcoa 43
Inside surface as cast	Better than 125 micro in.

process, the mold is made of a mixture that is basically sand and gypsum cement. With this mold material, molds could be made that were physically strong enough to be handled in the shop without retaining them in the flasks. The surface where the mold material contracted the pattern was smooth and free of pin holes and intergranular interstices so characteristic of a sand mold. Because, however, the mold material is about 50 percent sand and the balance recrystallized gypsum, the permeability of the mold was about the same as that of a sand mold, a marked advantage over an all plaster mold.

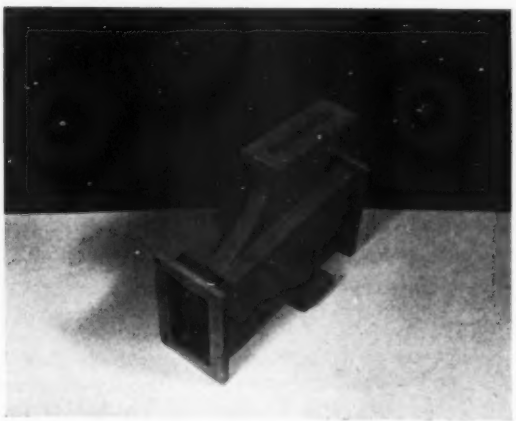
Improvements have been made steadily until today the Antioch process* is capable of producing aluminum castings of almost any size with great accuracy.

Basically, the Antioch process should be classed as a sand casting process for aluminum. While other non-ferrous metals can be cast, the foundry techniques are not well worked out. Further, this process is, in most cases, somewhat more expensive than sand casting so that it cannot compete unless the high degree of precision possible more than offsets the cost of machining a sand casting.

Where the Antioch process is pre-eminent is in casting those pieces that cannot be made economically by any other process.

CASTING SIZE — There appears to be no practical limit to the size of aluminum castings that can be made by the Antioch process. At the present time, the largest casting that has been made weighed 2000 lbs. after trimming and ready for shipment. While large, there is no indication that this is the largest

continued on page 132



Complex throat section for radar wave guide. Inside surface meets standing wave ratio requirements tested on several frequencies. Center wall terminal sections are .032" thick. Tolerance on individual openings plus or minus .020" with same tolerance on combined openings.

SPECIFICATIONS

Weight	20 lbs.
Length	15½ inches
Alloy	Alcoa 355T51
Inside finish as cast	Better than 100 micro in.

Mechanical Properties (Separately cast test bars)

	Minimum	Typical
Tensile	25,000	28,000
Yield		24,000
Elongation		1.5%
Brinell		65

*Practiced by Morris Bean & Co., Yellow Springs, Ohio.

DIE CAST housings have many advantages

- Heat dissipation
- Built-in supports
- Unlimited shapes
- Attractive appearance
- Rugged protection
- Close dimensions

By E. ERDMAN*

THE high degree of flexibility of the die casting process has made it the unquestioned leader as a method of making housings of all sorts. In either zinc or aluminum, die cast housings can perform a plurality of simultaneous functions from a simple cover, which may or may not be dust, vapor and moisture tight, to a functional part which incorporates the simpler functions combined with such features as heat dissipation, mechanical support of components, oil and grease retention and many others.

Even in the narrow field of use where the housing is simply a means of covering the operating components, there are a few, if any, materials than can seriously compete with a die casting. Particularly, in the case of aluminum, the different types of surface finish and the range of colors that can be used is unmatched by any other type of material including the omnipresent and highly publicized plastics.

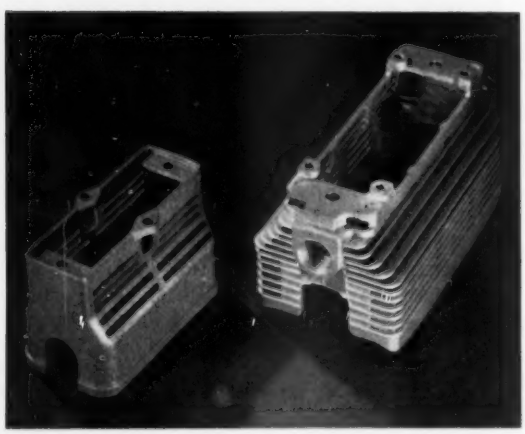
Protection of the housed parts against accident is another of the advantages of a die cast housing. In many cases, where an accidental blow would severely dent a sheet metal or break a plastic housing, a die casting will absorb the shock with no damage to either the machine or to the housing itself.

Provisions can be made for the use of almost any sort of fastening device, including machine screws, self-tapping screws, rivets, etc. The fact that it is an electrical conductor allows the die cast housing to be grounded when necessary to provide protection against electric shock.

Finally, the accuracy with which die castings can be made and the intricacy of coring that can be done enables housings to be cast on which no finish machining is necessary, and when necessary, holes, bosses, lugs, etc., can be sufficiently and accurately located so that mechanical components can be mounted, aligned and located within 0.005 per inch. In some cases, depending upon desigr., even closer positioning can be secured.

The several different housings used by the Dremel Mfg. Co., of Racine Wisc., illustrate some of the advantages noted above.

*Dremel Manufacturing Co.



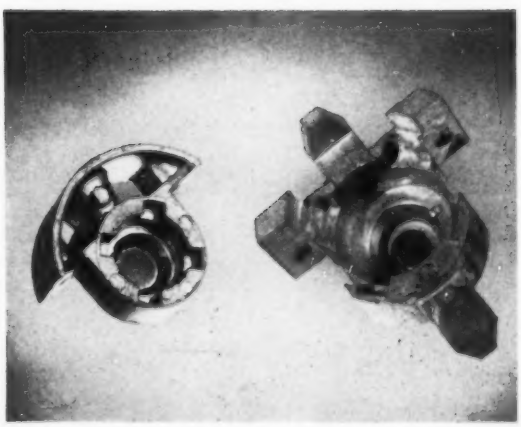
The electric sander is made in two sizes, the smaller one for the hobbyist has a zinc die cast housing, made by Acme Die Casting Co., of Racine, Wisc., and the larger, semi-professional model, an aluminum die cast housing made by Federal Die Casting Co., of Chicago, Ill. Functionally, both housings are the same—they serve to cover the mechanical and electrical components and provide, through ribbing and open slots, adequate cooling so that the tools can be used continuously. Accurately positioned mounting holes permit assembly of the sanders without secondary machining.

From the shape of these housings, it is immediately obvious that plastics might also be used if strength were not a consideration. The rough use that these tools receive, however, precludes the use of anything other than metal for the housings.

Illustrative of the type of housing which combines a simple housing with accurately cored and positioned provisions for mounting mechanical components is the front housing used on the electric screwdriver and electric eraser, above.

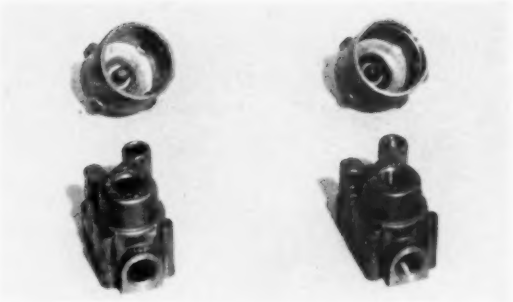
This zinc die casting, made by the Racine Die Casting Co., of Racine Wisc., furnishes simultaneously a smooth attractive, strong housing into which a preassembled slip clutch and the necessary bushings can be pressed. In order to furnish access to some of the parts and to provide a means of holding and adjusting the thrust bearing, a threaded port is included in the casting.

Illustrated, right, are zinc die castings used by Dremel Mfg. Co. showing two possible finishes on the same part. The one is chromium plated and has a so-called hardware finish, while the other one is simply spray painted and baked. Both finishes are hard and durable and can be applied with equal facility to the castings. If aluminum were used for these parts, the type of surface finish could be expanded to include a simply polished casting.



A somewhat less obvious, but nonetheless important member of the housing family is illustrated by the two bearing brackets, left. These brackets are so designed that the zinc die castings are complete and ready for use as they come from the trimming die. Spherical bushings are used and the caster, the Acme Die Casting Co., of Racine, Wisc., is able to hold the spherical seat in the bushing housing to sufficiently close tolerances so that it can be used as cast. Location of the cored holes is important since the bushing housing must be positioned with respect to the field coils of the motor so that the air gap between rotor and stator is the desired amount and uniform.

A SEPARATE bimetallic temperature control unit was required when these housings were made of other metals. Now, as an aluminum die casting, the housing acts as one member of the bimetallic unit, and reduces costs considerably.



DIE CAST ALUMINUM housing serves as element in bimetallic thermostat

ONE of the problems facing the designer of thermostatic oven controls is compensation for element head expansion due to changes in ambient temperature.

Steel, brass, and bronze have all been used as materials of construction for the housings and in all cases a bimetal compensating unit had to be included in the operating mechanism to effectively maintain a correct control setting.

By redesign of the castings and some of the internal mechanical parts, the engineers of the Robertshaw-Fulton Division of American Thermometer Co. were able to utilize the high thermal expansion of aluminum as one element of the temperature compensating device so that a separate bimetallic unit became unnecessary. As a result of this redesign, the thermostat castings can now be made as aluminum die castings at a very considerable saving in manufacturing cost.

A secondary advantage resulting from the use of aluminum die cast housings is the high corrosion resistance of the unpainted or otherwise finished metal. While it has not been possible to eliminate all of the machine work on the head castings, it has been greatly reduced.

Two die castings are shown above as they are received from the foundry of the Doehler-Jarvis Co. of Chicago, Ill. Because certain of the dimensions must be held more closely than the foundry can accommodate and because three faces must be flatter than normal production techniques will give; the general dimensional accuracy of these castings is rather loose.

On the other hand, the four cored holes that fasten the two castings together are positioned carefully enough so that after tapping, the two castings can be rotated in 90 degree increments and maintain alignment of the holes. In addition, one of the castings (above, right) has 2 holes that are tapped for standard pipe threads. In order to make the tapping operation faster, the taper on the core pins is the same as the taper on a pipe tap.

On the one casting that carries the thermal element, but does not contain any gas (above, left), final machining operations are:

1. Face for gasket
2. Bore and thread ID
3. Drill and ream gland hole
4. Drill entry hole for capillary tube
5. Tap all holes requiring threads

On the other casting final machining is:

1. Face for gasket
2. Machine diaphragm seat
3. Drill bypass and pilot light holes
4. Tap all holes requiring threads

The exterior surfaces are left as cast with no polishing, buffing or other finishing operation.

As a final step, the assembled housings are 100 percent inspected, using air, natural gas and bottled gas at about 3½ psi pressure.

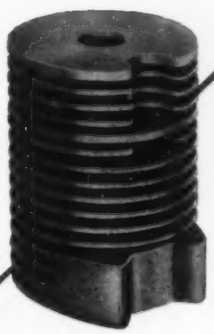
LIGHT METAL CASTINGS

for AIRCRAFT or HOME APPLIANCES...

check Thompson's CREATIVE CASTINGS–

for **GREATER STRENGTH**
to **WITHSTAND HEAT**
for **WEIGHT SAVING**
to **SAVE ON FINISHING**

APPLIANCE
Motor End Frames



AIRCRAFT
Carbon Pile Regulator

APPLIANCE
Garbage Disposal Housing

AIRCRAFT
Alternator Housing

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An investment casting made of
BERYLCO BERYLLIUM COPPER

The work of this beryllium copper push pawl, part of a business machine time recorder, was once done by an assembly of two stampings and a separator. It lacked the necessary strength and rigidity, loosened in operation. Users complained; repair costs were high. Now, however, its one-piece simplicity assures foolproof operation. Its hardness assures long wear. And because of its added castability, the designer reduced costs 25 percent by selecting Berylco over any other high strength material.

Investment casting often has many advantages over sand casting or machining in the production of small, intricate parts. Berylco beryllium copper offers many cost-saving opportunities as an investment casting material.

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Increased advertising and greater experience are making more and more designers aware of the advantages of Berylco beryllium copper. Why not plan now to increase your range of alloys? Berylco is available in 5 lb., 2½ lb. and 3 oz. ingots. Send your trial order in today.

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TECHNICAL REPORT ON SHELL MOLD PROCESS ISSUED BY GOVERNMENT

Technical advances which enable the manufacturers of metal castings to make better and wider application of the new shell mold casting process are described in a technical report now available from the Office of Technical Services of the U. S. Department of Commerce.

The section on equipment for the process describes designs for: molding machines, a core blowing machine, mold stripping equipment, curing ovens, investment mixing equipment, and mold bedding boxes.

Under "Improvement of Processes Techniques" the report describes compositions and methods for applying molding resins, sands, parting agents wetting agents, investment additives and spray coats; also the procedure for securing and bedding molds.

Another section of the report describes experimental job lot production of shell-mold castings in aluminum ductile cast iron and carbon steel. This is followed by the description of an investigation of the effects of changes in the shell-mold casting procedure on soundness and macrostructure of the metal.

In a concluding section, the report presents the recommendations of the Navy metallurgists for the best practice in: production equipment and mechanization, investment materials, sands, investment mixing, pattern equipment, gating and heading, dimensional tolerance, closing molds, cores, and plant safety.

PB 111004, Report of Investigation of the Shell Molding Process, Mimeo $1.50. Orders should be addressed to the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., accompanied by check or money order payable to the Treasurer of the United States.

1. OPTICAL GAGING consumed only 40 seconds to inspect this sintered brass rotor and saved, in addition hundreds of hours of engineering time.

2. MECHANICAL GAGING which has been replaced, took four minutes and the 27 individual gages to complete the same inspection.

Optical Gaging for economical inspection of SINTERINGS

SMALL sinterings can readily be inspected by optical gaging.

Typical of this method of inspection is the use of an optical comparator for checking tolerances on a small, sintered brass rotor whch is one of the best known jobs now being manufactured by powder metallurgy*.

This component produced for Army Ordnance offers a clearcut example of the economy of optical gaging for the inspection of close tolerance sinterings.

Here is a comparison of optical vs mechanical gaging:

- The girl in Figure 1 takes 40 seconds for complete inspection of the piece. Without need for training in precision gaging or exercise of judgment on tightness of fit, she passes or rejects each piece in 40 seconds and has another piece in position.

- The same inspection took four minutes when done with the 27 mechanical gages grouped in Figure 2. To inspect the tolerances, 27 gages had to be made to an accuracy of .0003 on six dimensions, .0002 on 15 dimensions, .0001 on 19 dimensions and .00007 on one dimension.

But examine the comparison more closely with regard to cost of equipment, ultimate effectiveness, labor required to make changes and convenience.

Design of the mechanical gages took 380 hours of engineering time and 475 hours of tool-making time. Since one set is not enough because weekly inspection and repair requires a complete standby set of gages, a duplicate set was made. In addition, surveillance inspection of gages re-

***See "Powder Metallurgy produces a brass ordnance component," by Capt. John Dale, PMM, Feb. 1952, p 34; and "Method of Machining Carbide Die for odd-shaped powder part illustrates new way of cutting hard materials" by John S. Roller, PMM, Mar. 1952, p 47.**

quired about 40 hours per week.

The holding fixture required for the optical comparator can be examined in Figure 3. Design and manufacture of this fixture and the inspection chart took about one-third the 855 hours required for a single set of mechanical gages. The difference in cost between the fixture-chart combination for an optical comparator, and the equivalent mechanical gages, is greater than the cost of the optical gaging projector.

Of course, the projector is standard equipment which can be used with many other inspection jobs, requiring only a new holding fixture and chart. The optical comparator illustrated above is a Kodak Contour Projector manufactured by Eastman Kodak Co.

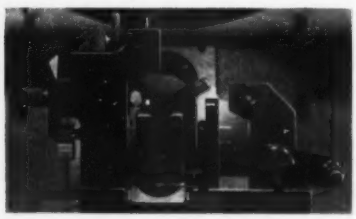
How does an optical comparator work?

The operator slips the part she is inspecting into different positions on this holding fixture and watches the accurately magnified shadow.

If the shadow lets a sliver of light pass by certain opaque lines on the screen and overlaps others, dimensions are within tolerance limits.

She also watches certain images originating not on the part but on the interposer pins which indicate thicknesses, hole depths and other dimensions by their positions.

When an engineering change may be made in a part, it is only necessary in most instances to reposition lines on the chart rather than reworking the gages as is true when mechanical gages are used.



3. THIS FIXTURE for the optical comparator took one-third the tooling time needed to build the mechanical gages.

Complex shapes with multiple dimensions to control are reported to be as easy to accommodate in this type of contour projector as are the relatively simple shapes, although the greater the number of inspections which can be incorporated into the optical unit, the greater will be its economy as compared with mechanical gaging systems.

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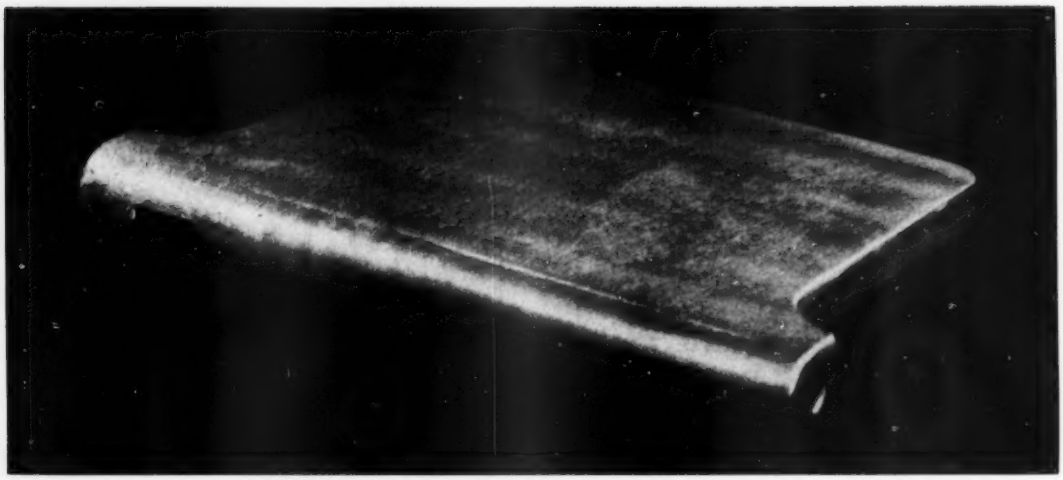


"FINISHING of the head rest is simply by polishing and anodizing, since, being of aluminum, no plating is required. Lowest finished piece costs among the three processes considered have been obtained . . ."

Surface Finish Dictates a PERMANENT MOLD CASTING

By ROY T. ADOLPHSON*

THE choice of a permanent mold casting for the head rest of surgical operating tables manufactured by the Shampaine Co. of St. Louis, Mo., reflects the careful consideration that must be given to even simple components if the most satisfactory product, at the lowest manufacturing cost, is to be secured.

The basic requirements for this head rest are that it be strong, rigid, flat, lightweight and smooth. Based upon these fixed requirements and upon a relatively limited production, there appeared to be only three possible methods of production; sand casting, a welded frame covered with sheet metal, and permanent mold casting (quantities are too small to warrant die casting).

As either a sand or permanent mold casting, the most desirable material is aluminum while with a welded frame covered with sheet metal, the frame could be low carbon steel members and the covering material stainless steel.

The greatest disadvantage of a sand casting is its porosity making surface finishing expensive and causing a high rejection rate due to macro-porosity disclosed when the cast skin was removed. A sand casting further required boring the pivot holes as a separate operation and required a relatively elaborate fixture.

On the underside of the head rest, four bosses are needed for mounting the raising and lowering bracket. These bosses must be drilled and tapped and the slot between them milled, since a sand casting would not give the accuracy needed. For these operations, a second fixture was required.

The sum of first cost of the casting, plus tooling and machining, plus finishing, resulted in a final cost that was disproportionately high.

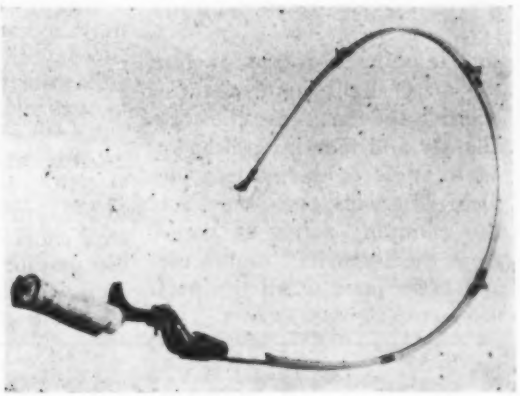
As a member made up by welding a frame and covering it, the first and most obvious disadvantage was the excessively high amount of hand labor using skilled mechanics. Both welding operations and stretching the skin over the frame were hand operations with subsequent high costs.

While this type of construction resulted in a smooth-finished surface, without a separate

continued on page 92

*Chief Engineer, Shampaine Co., St. Louis, Mo.

"MANUFACTURE OF HANDLES has been reduced to as automatic an operation as is possible to help hold costs down. To insure adequate strength and proper balance, combined handle and reel seat are an aluminum die casting . . . "



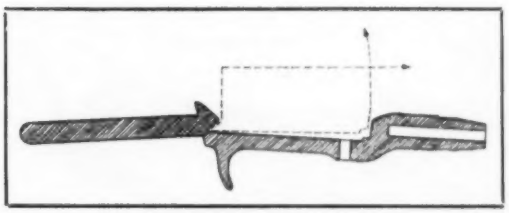
Special coring forms undercut in DIE CAST fishing rod handle

By CHRIS LARSEN*

PROPER balance for minimum muscular fatigue is a paramount consideration in the design of bait casting rods for the fishing fraternity Coupled with balance is adequate flexibility and enough backbone to cast a plug weighing ⅝ ounces or less, a reasonable distance. Since proper casting is done with a wrist motion only, the casting power comes from flexing the rod.

The extruded glass rod, Figure 1, manufactured by the Wright & McGill Co., encompasses all of the desirable features noted. To give proper balance and at the same time, to insure adequate strength, the combined handle and reel seat are an aluminum die casting as is the collet nut.

Because the manufacture of bait casting rods involves a number of hand operations with their attendant high cost, the manufacture of the handles has been reduced to as automatic an operation as is possible to help hold costs down.



"CORE is built so that the first slight movement of opening the dies rocks the core slightly and then pulls it at an acute angle to the face of the dies."

As made by the AurCola Mfg. Co. of Aurora, Colo., two handles and two nuts are cast per shot. All holes and recesses are cored except for a small hole (about a No. 10) in the extreme end which is drilled and tapped as a separate operation. The reel is locked in position with a thumb screw and clamping plate on the forward mount. This requires a recess in the butt of the seat to accommodate the rear reel mount.

Coring of the die to secure the required holes and recesses is, in some respects, quite unusual. The butt recess, the flat for the reel and the front clearance are a single core. Removal of this core by a straight pull is, obviously, impossible due to lack of clearance. The

continued next page

*Chief Engineer, Wright & McGill Co., Denver Colo.

core is built, therefore, so that the first slight movement of opening the dies rocks the core slightly and then pulls it at an acute angle to the face of the dies. The clearance hole for the clamping screw is cored from the fixed half of the die and is stripped when the part is ejected.

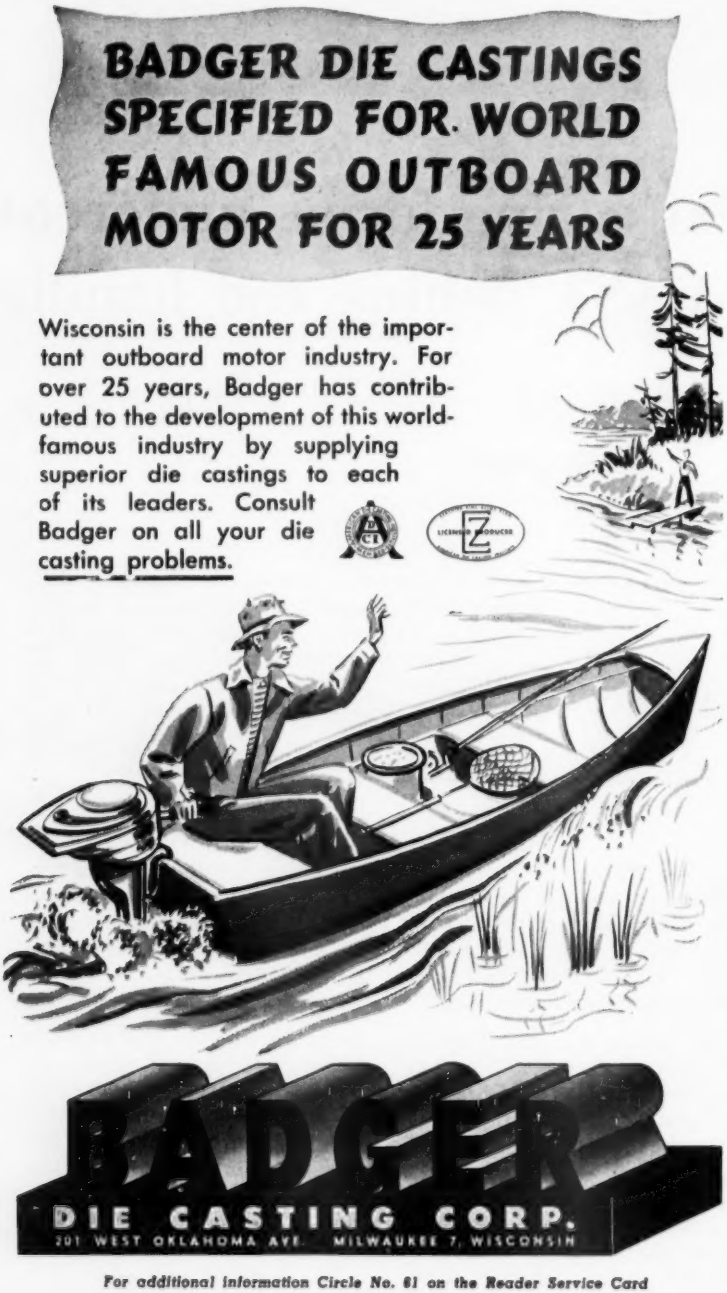
One other hole must be cored in this handle. The rods are fitted with a brass ferrule to slide into the handle. To prevent turning, this ferrule has a square section and to make disassembly easy, is tapered. A matching hole must be formed in the handle with sufficiently thin walls so that only moderate pressure exerted by tightening the collet nut will cause adequate gripping of the rod by the handle. Probably no other method of manufacture would enable the formation of a proper hole in the handle at a tolerable cost.

As a further cost reducing measure, the collet threads are formed in the casting operation. Here again, precision of workmanship in the manufacture and setup of the die has obviated any secondary machining since not even a chasing operation is required.

All of the factors leading to low final manufacturing cost that have been noted for the rod handle are true in the collet nut. As a result, the secondary operations after casting are few and simple. Thin flash and burs are removed from the handles by barrel tumbling using no deburring media. Heavier flash along the parting line is removed by sanding on a belt sander. The nuts are trimmed by a press operation.

Following deburring and trimming, the small amount of machine work needed is done. The small base hole in the handle is drilled and tapped and the two saw cuts are made in the collet so that it will grip the rod. On the nut, the internal thread is cut so that it can be screwed onto the handle. These are the only machine operations performed.

Finishing is equally simple. The rod handles and nuts are degreased and then etched in Oakite No. 36 to give a good surface for the paint to bond on. Following a hot water rinse, the parts are automatically spray painted and baked, thus finishing the handles except for application of the cork grip.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TO REPRESENT TACO WEST

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PRECISION METAL MOLDING'S

1953 2nd ANNUAL POWDER METALLURGY DIRECTORY

PRECISION METAL MOLDING presents here its yearly guide to the powder metallurgy industry. It is a reference work compiled from questionaires submitted to the companies listed.

Listings presented here conform as closely as possible to information supplied by each company. Since many of the companies listed here do not have catalogs, this is the only complete products listing available for them.

Two listings are presented in the following pages: listing in alphabetical order and by products manufactured. Each of these is subdivided into three groups: fabricators of sinterings, producers of metal powders, and manufacturers of equipment used in powder metallurgy.

Names of advertisers are listed in bold type. To locate the advertisements of these companies, please check in the advertisers' index beginning on page 135.

The Editors

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ALPHABETICAL LISTING

of Fabricators, Equipment Manufacturers and Powder Suppliers

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American Sintered Alloys Div.
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Subsidiary of Chrysler Corp.
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Bound Brook Oil-less Bearing Co.
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Schiller Park, Ill.
(bearings, structural parts, electrical components).

Henry L. Crowley Co., Inc.
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West Orange, N. J.
(structural parts, cores, electrical components).

Detroit Sintered Metals Corp.
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Detroit 28, Mich.
(bearings, structural parts, magnetic materials, electrical components).

Dixon Sintaloy, Inc.
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(contact materials, heavy metal)

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Akron 5, Ohio
(friction materials)

General Powdered Metal Products, Inc.
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Gibson Electric Co.
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Pittsburgh 21, Pa.
(contact materials).

International Powder Metallurgy, Inc.
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Ridgway, Pa.
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Indiana Steel Products Co.
Valparaiso, Ind.
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Keystone Carbon Co.
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St. Marys, Pa.
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Kwikset Locks, Inc.
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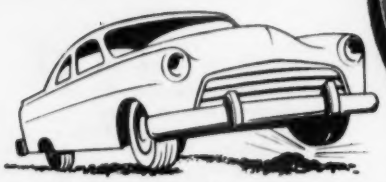

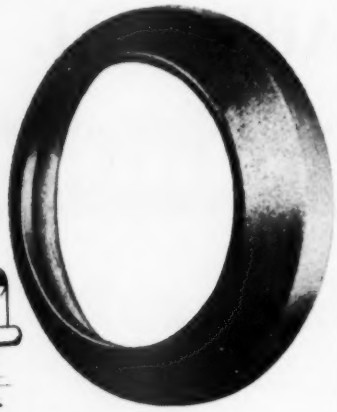

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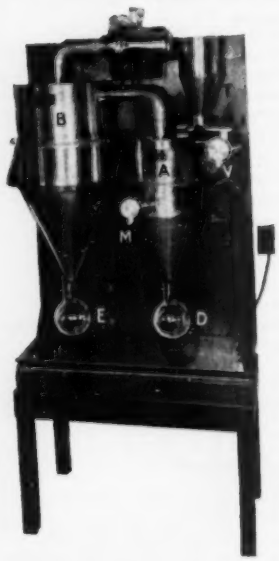

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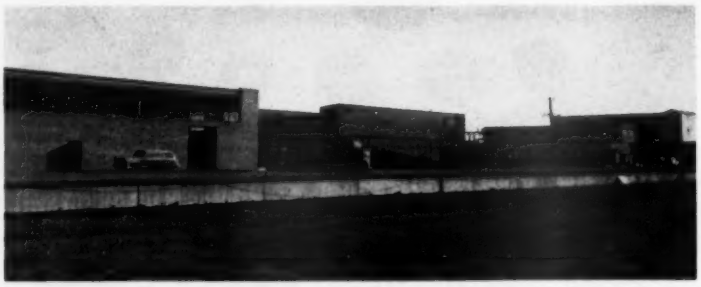

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New York, N. Y.
(Copper; tin; silver; brass; bronze)

Antara Chemical Div.
General Dyestuffs Corp.
435 W. Hudson St.
New York 14, N. Y.
(Carbonyl iron only)

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.
(Brass; copper; iron; lead nickel; steel; tin; zinc)

Easton Metal Powder Co.
900 Line St.
Easton, Pa.
(iron)

Ekstrand & Tholand, Inc.
441 Lexington Ave.
New York, N. Y.
(Iron)

Fansteel Metallurgical Corp.
North Chicago, Ill.
(tungsten, molybdenum)

Ferrum, Ltd.
506 Ste. Madeleine Blvd.
Cap de la Madeleine
Quebec, Can.
(Iron)

Glidden Co.
1396 Union Commerce Bldg.
Cleveland 14, Ohio
(copper, lead)

Greenback Industries
Greenback, Tenn.
(Copper; tin; brass)

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.
(Aluminum; brass; copper; iron; lead; nickel; steel; tin; zinc)

Hoeganaes Sponge Iron Corp.
545 Fifth Ave.
New York 17, N. Y.
(Iron)

Magnetic Powders, Inc.
Fairview Ave.
Johnsonburg, Pa.
(Iron)

Malone Metal Powders, Inc.
220 West 42nd St.
New York 36, N. Y.
(Copper)

Metal Hydrides, Inc.
16 Congress St.
Beverly, Mass.
(Zirconium, titanium, chromium, metal hydrides and alloy powders)

Metal Powders, Ltd.
73 Fifth Ave.
Iberville Quebec, Can.
(Iron, iron alloys, iron-copper)

Metals Disintegrating Co.
P. O. Box 290
Elizabeth B, N. J.
(Aluminum; brass; copper; iron; lead; nickel; tin; zinc; bronze)

Metasap Chemical Co.
Harrison, N. J.
(Metal stearates)

National Lead Co.
111 Broadway
New York 6, N. Y.
(Lead, tin))

Plastic Metals Div.
National Radiator Corp.
195 Bridge St.
Johnstown, Pa.
(Iron; nickel; steel; manganese; silicon)

New Jersey Zinc Co.
160 Front St.
New York 38, N. Y.
(Brass; copper; zinc; nickel silver; bronze)

Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.
(Iron; steel; titanium; zirconium; silicon; boron)

Pyron Corporation
P. O. Box 246 La Salle Sta.
Niagara Fall, N. Y.
(Iron)

Reynolds Metals Co.
2500 S. Third St.
Louisville, Ky.
(Aluminum)

George R. Smith Co., Ltd.
448 S. Hill St.
Los Angeles 13, Cal.
(Iron; copper)

Sylvania Electric Products, Inc.
Tungsten & Chemical Div.
P. O. Box 70
Towanda, Pa.
(Tungsten powders)

Vanadium Alloys Steel Co.
Latrobe, Pa.
(Stainless steel; pre-alloyed steel)

Soon Available

SWEDISH SPONGE IRON POWDER
from a DOMESTIC SOURCE

With the completion of our new powder-making facilities in the United States, we will be in a position to supply your needs for high quality sponge iron powder.

This will not be "just another plant" for producing iron powder, but will feature the newest and best equipment available for quality control. Our modern laboratory facilities will assure constant and dependable control of powder quality, identical in physical and chemical properties from shipment to shipment.

HOEGANAES SPONGE IRON CO.
545 Fifth Ave., New York 17, N. Y.

Distributed By
EKSTRAND & THOLAND, INC.
441 LEXINGTON AVE.
NEW YORK 17, N. Y.

For additional information Circle No. 70 on the Reader Service Card

PRODUCT SOURCES

Sinterings, Equipment and Powder

Components Fabricators

BEARINGS

Copper or Iron Base

American Electro Metals Corp.
320 Yonkers Ave.
Yonkers, N. Y.

American Sintered Alloys Div.
Yale & Towne Mfg. Co.
Box J.
Bethel, Conn.

Amplex Mfg. Co.
Subsidiary of Chrysler Corp.
6501 Harper
Detroit 31, Mich.

Bound Brook Oil-less Bearing Co.
Lincoln Blvd.
Bound Brook, N. J.

Chicago Powdered Metal Products Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.

General Powdered Metal Products, Inc.
523 West Ave.
Norwalk, Conn.

International Powder Metallurgy Co., Inc.
439 W. Main St.
Ridgway, Pa.

Johnson Bronze Co.
500 S. Mill St.
New Castle, Pa.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Magnetic Core Corp.
2 Croton Ave.
Ossining, N. Y.

Metal Powder Products, Inc.
415 W. Fifth St.
Dayton, Ohio

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, Ohio

National Molded Products, Inc.
40-42 S. St. Marys St.
St. Marys, Pa.

Parker White-Metal Co.
2153 McKinley Ave.
Erie, Pa.

Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.

Powder Metal Products Corp.
St. Marys, Pa.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products
Commerce St., Box 129
Ellwood City, Pa.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Wel-Met Co.
Div. Ferro, Inc.
Kent, Ohio

BEARINGS

Other types

Keystone Carbon Co.
State St.
St. Marys, Pa.

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.
(oil-wall types)

Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.
(nickel silver)

CONTACT MATERIALS

Pure metals (platinum, silver, etc.)

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.

Fansteel Metallurgical Corp.
North Chicago, Ill.

International Powder Metallurgy Co., Inc.
439 W. Main St.
Ridgway, Pa.

Keystone Carbon Co.
State St.
St. Marys, Pa.

P. R. Mallory & Co., Inc.
3029 W. Washington St.
Indianapolis 6, Ind.

Sintered Metals, Inc.
3390 Washington St.
Jamaica Plain
Boston 30, Mass.

CONTACT MATERIALS

Tungsten copper, tungsten silver, etc.

Fansteel Metallurgical Corp.
North Chicago, Ill.

Gibson Electric Co.
8436 Frankstown Ave.
Pittsburgh 21, Pa.

P. R. Mallory Co
3029 E. Washington St.
Indianapolis 6, Ind.

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

CORES

High Frequency

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.

Magnetic Core Corp.
2 Croton Ave.
Ossining, N. Y.

Powdered Metal Products Corp. of America
9335 W. Belmont Blvd.
Franklin Park, Ill.

Radio Cores, Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

CORES

Low Frequency

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.

Magnetic Core Corp.
2 Croton Ave.
Ossining, N. Y.
Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.
Radio Cores, Inc.
9540 Tulley Ave.
Oaklawn, Ill.
Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

ELECTRICAL COMPONENTS

Carbon Brushes

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.
Keystone Carbon Co.
State St.
St. Marys, Pa.
Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

ELECTRICAL COMPONENTS

Collector Rings

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.
Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.
P. R. Mallory & Co., Inc.
3029 E. Washington St.
Indianapolis 6, Ind.
Metal Powder Products, Inc.
415 W. Fifth St.
Dayton, Ohio
Parker White-Metal Co.
2153 McKinley Ave.
Erie, Pa.
Powdercraft Corp.
746 Hayne St
Spartanburg, S. C.

ELECTRICAL COMPONENTS

Commutator Segments

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.
Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.
P. R. Mallory & Co., Inc.
3029 E. Washington St.
Indianapolis 6, Ind.
Sintered Metals, Inc.
3390 Washington St.
Jamaica Plain
Boston 30, Mass.

ELECTRICAL COMPONENTS

Pole Pieces

American Electro Metal Corp.
320 Yonkers Ave
Yonkers, N. Y.
American Sintered Alloys Div.
Yale & Towne Mfg. Co.
Box J.
Bethel, Conn.
American Tool Works
Powder Metallurgy Div.
132 Allyn St.
Hartford 3, Conn.
Bound Brook Oil-Less Bearing Co.
Lincoln Blvd.
Bound Brook, N. J.

POWDERMET SUCCESS STORY NO. 17

HOLDING LOCK PLUG TOLERANCES TO ±.0005"!

Formerly the manufacturer had to broach these small lock plugs in order to hold a tolerance of plus or minus .0005". Naturally the machining operation was costly and time-consuming. It was obviously desirable to use powdered metal but because of the extremely close tolerances it was considered unworkable.

Then they came to Powdered Metal Products Corporation of America and discovered PMP could supply plugs to the required tolerances and still substantially lower the cost. There was no sacrifice of quality or wear characteristics. In fact the PMP plug withstands repeated tests of over 500,000 cycles—much more than encountered in normal use.

If you have a problem involving production parts, why not consult Powdered Metal Products? Their complete facilities assure finest results.

Write today for complete information.

sign of leadership PMP in powder metallurgy

POWDERED METAL PRODUCTS CORPORATION *of America*

9335 West Belmont Avenue,
Franklin Park, Illinois

*Trademark

For additional information Circle No. 53 on the Reader Service Card

Chicago Powdered Metal Products Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Dixon Sintaloy, Inc.,
535 Hope St.
Stamford, Conn.

General Powdered Metal Products, Inc.
535 West Ave.
Norwalk, Conn.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain
Boston 30, Mass.

Metal Powder Products, Inc.
415 W. Fifth St.
Dayton, Ohio

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, Ohio

Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Sintered Metals, Inc.
3390 Washington St.
Jamaica Plain
Boston 30, Mass.

American Tool Works
Powder Metallurgy Div.
132 Allyn St.
Hartford 3, Conn.

ELECTRICAL COMPONENTS

Rotor Segments

American Tool Works
Powder Metallurgy Div.
132 Allyn St.
Hartford 3, Conn.

Henry L. Crowley Co., Inc.
1 Central Ave.
West Orange, N. J.

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.

General Powdered Metal Products, Inc.
523 West Ave.
Norwalk, Conn.

Metal Powder Products, Inc.
415 W. Fifth St.
Dayton, Ohio

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Sintered Metals, Inc.
3390 Washington St.
Jamaica Plain
Boston 30, Mass.

FRICTION MATERIALS

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.
(all types)

General Metals Powder Co.
130 Elinor Ave.
Akron 5, Ohio
(all types)

International Powder Metallurgy Co., Inc.
439 W. Main St.
Ridgway, Pa.
(clutch parts)

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, Ohio
(steel backed facings)

Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.
(copper base)

Presmet Corp.
112 Harding St.
Worcester, Mass.
(clutch parts)

S. K. Wellman Co.
200 Egbert Rd.
Bedford, O.
(all types)

IRON POWDERS
STEEL POWDERS
IRON ALLOY POWDERS

METAL POWDERS MPL LIMITED

A Canadian Product

Your Inquiries Welcomed

METAL POWDERS LTD.

73 - 5th AVE. IBERVILLE, QUEBEC
CANADA

For additional information Circle No. 111 on the Reader Service Card

In Powder Metallurgy

METASAP STEARATES

assure

INCREASED GREEN DENSITY OF COMPACT
REDUCED EJECTION PRESSURE

As little as 0.05 percent of a Metasap stearate mixed with your powder will increase compacts by as much as 10 percent — **without increase of applied pressure.** This is because the outstanding lubricating qualities of Metasap stearates greatly reduce interparticle friction, enabling particles to move more freely with respect to each other, and thus compact more easily and efficiently.

Addition of as little as 0.05 percent of a Metasap stearate also means **easier ejection.** And lowered ejection pressures result in stepped-up production, fewer rejects, better finished products.

Profit by putting Metasap stearates to work for **you.** Metasap zinc, aluminum, magnesium and lead stearates are all immediately available in any quantities. Write for trial samples today.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

METASAP CHEMICAL COMPANY

Harrison, New Jersey

Chicago Boston Cedartown, Ga. Richmond, Calif.

For additional information Circle No. 110 on the Reader Service Card

POSITION WANTED

with a coil that has an important job to do, by a core made of G A & F Carbonyl Iron Powders. Core offers know-how born of long experience, high permeability, high Q, unusual stability and references from many major employers....

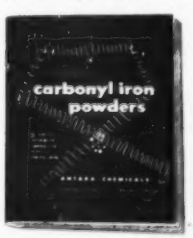
G A & F Carbonyl Iron Powders are used to produce cores for transformer and inductor coils of every form—to increase Q values, to vary coil inductances, to reduce the size of coils, to confine stray fields and to increase transformer coupling factors.

These powders are microscopic, almost perfect spheres of extremely pure iron. They are produced in seven carefully controlled types, ranging in average particle-size from three to twenty microns in diameter.

Similarly, their properties vary, making them useful in many different applications. Engineers have commented on the fact that cores made from these powders lend themselves to smoothness of adjustment and to ease of grinding. The extremely small size of the particles is of enormous value, since eddy currents develop only within each particle—proportional to the square of the particle diameter.

We urge you to ask your core maker, your coil winder, your industrial designer, how G A & F Carbonyl Iron Powders can increase the efficiency and performance of the equipment or product you make, while reducing both the cost and the weight.

Write for wholly new 32 page book—the most comprehensive treatment yet given to the characteristics and applications of G A & F Carbonyl Iron Powders. 80% of the story is told with photomicrographs, diagrams, performance charts and tables. For your copy—without obligation—kindly address Department 41.



G A & F® CARBONYL IRON POWDERS

MEMBER mpa METAL POWDER ASSOCIATION

ANTARA® CHEMICALS

Division of GENERAL DYESTUFF CORPORATION

435 HUDSON STREET • NEW YORK 14, NEW YORK

gdc ANTARA

For additional information Circle No. 8 on the Reader Service Card

For additional information Circle No. 103 on the Reader Service Card

NATIONAL CARBIDE DIE CO.

PRODUCTION RECORD
OVER 1,000,000 POWDERED METAL GEARS FROM THIS NATIONAL CARBIDE DIE. APPROXIMATELY 10,000 POWDERED METAL GEARS FROM BEST STEEL DIE.

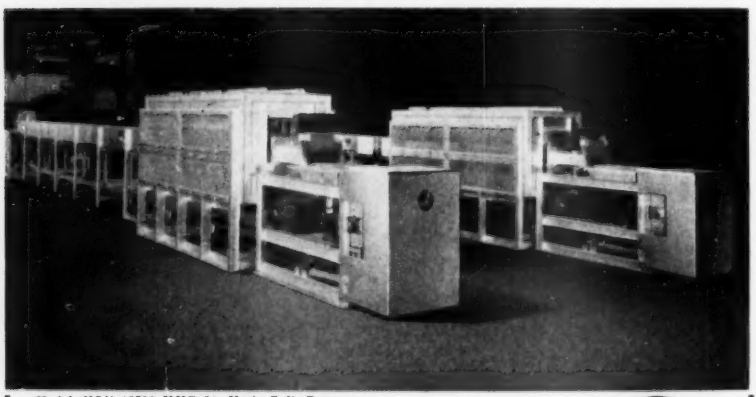
GEARED

to produce

Dies of

TUNGSTEN CARBIDE with punches and core rods for POWDERED METAL PARTS

NATIONAL CARBIDE DIE Company
Greenock Road
McKeesport 2, Pa.



Model HOU-12596-MMB-21 Mesh Belt Furnaces. Maximum Temperature 2100F.

Another Fabricator Buys

Shown above are two Harper Electric Continuous Mesh Belt Furnaces recently installed in the plant of a well-known fabricator of powdered metal products.

For detailed information on special and standard high producing Harper Electric Mesh Belt Furnaces, write to Department 15. Or, if attending the Metal Powder Show, VISIT HARPER BOOTH NO. 17, METAL POWDER SHOW, CLEVELAND, APRIL 20-22, 1953

SINTERING FURNACES

These quality built furnaces feature:

- Longer belt life, through improved belt take-up design.
- Closer control of product dimensions through more positive control of preheat temperature.
- Substantial cost saving, through less down time and efficient use of electricity.

HARPER ELECTRIC FURNACE CORPORATION

Department No. 15, 39 River Street — Buffalo 2, New York

For additional information Circle No. 94 on the Reader Service Card

MAGNETIC MATERIALS (soft)

American Electro Metal Corp.
320 Yonkers Ave.
Yonkers, N. Y.
(iron silicon)

American Sintered Alloys Div.
Yale & Towne Mfg. Co.
Box J.
Bethel Conn.
(pure iron)

Detroit Sintered Metals Corp.
18434 Fitzpatrick Rd.
Detroit 28, Mich.
(pure iron)

General Powdered Metal Products Inc.
523 West Ave.
Norwalk, Conn.
(iron nickel)

Magnetic Core Corp.
2 Croton Ave.
Ossining, N. Y.
(iron-nickel)

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain
Boston 30, Mass.
(high density iron)

Metal Powder Products, Inc.
415 W. Fifth St.
Dayton, Ohio
(high purity dense iron)

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.
(all types)

Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.
(iron-nickel)

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.
(iron-nickel)

Sintered Metals, Inc.
3390 Washington St.
Jamaica Plain
Boston 30, Mass.
(Hardine)

MAGNETIC MATERIALS (hard)

Indiana Steel Products Co.
Valparaiso, Ind.
(alnico)

Magnetic Core Corp
2 Croton Ave.
Ossining, N. Y.

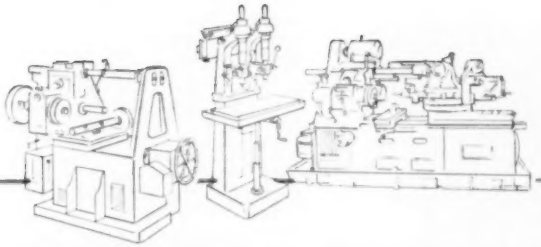
Powdercraft Corp.
746 Hayne St.
Spartanburg, S. C.

MISCELLANEOUS

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.
(bronze filters)

Fansteel Metallurgical Corp.
North Chicago, Ill.
(heavy metal parts)

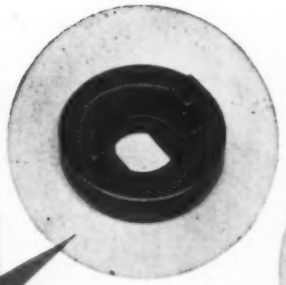
Magnetic Core Corp.
2 Croton Ave.
Ossining, N. Y.
(filters)

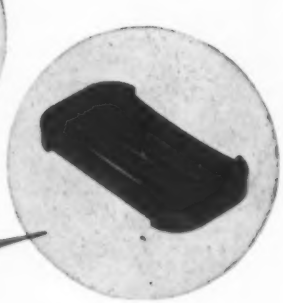


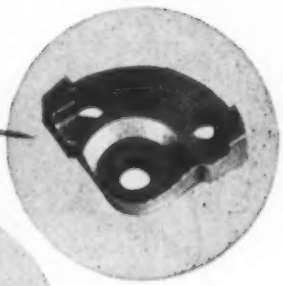
YOU DON'T ALWAYS NEED MACHINE TOOLS FOR FINISHED MACHINE PARTS

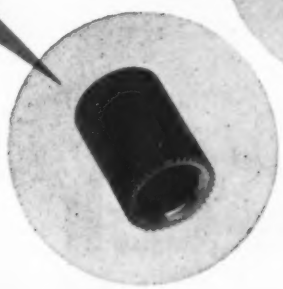
Specify OILITE

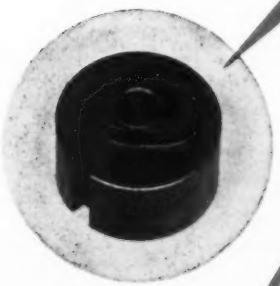
PRODUCTS OF SINTERED METALS

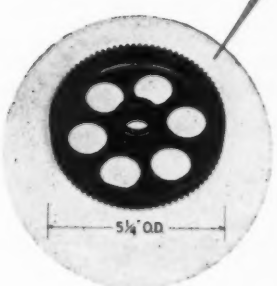












With OILITE YOU:

- Eliminate Machine Tools
- Eliminate Tooling Programs
- Conserve Skilled Man Hours
- Conserve Strategic Material
- Get Quick Delivery

Other OILITE Advantages Include:

- Over 20 Years Production Experience
- An Alternate Material
- Engineered Products
- No Machining
- Low Price
- Release Skilled Man Power For Other Jobs

And

Field Engineers and Depots throughout U. S. and Canada

SINTERED OILITE PRODUCTS

AMPLEX MANUFACTURING COMPANY

Subsidiary of Chrysler Corporation

Detroit 31, Michigan

Oilite Products include: BEARINGS, Finished Machine Parts, Cored and Solid Bars, Permanent Filters, and Special Units.

For additional information Circle No. 13 on the Reader Service Card

One Call Does It All!

A call to MD brings you direct to Metal Powder Headquarters and closer to the answer to your Powder Metallurgy problem.

For, as a pioneer in the manufacture of metal powders since 1916, MD has played a large role in the development of many of their uses in industry today as the *only* company which manufactures a complete line of metal powders. This has resulted in MD being the first source called on to supply an extensive line of powders for a wide range of applications.

Call on "Metal Powder Headquarters" for help on your metal powder problems. The advice and recommendations of the MD Sales Service Department are yours without obligation.

METALS DISINTEGRATING COMPANY, INC.
Elizabeth 8 • New Jersey

MD POWDERS
METAL POWDERS
METAL PIGMENTS
METAL ABRASIVES

Plants:
Elizabeth, N. J.; Manchester, N. H.; Berkeley, Calif.; Emeryville, Calif.

SUBSIDIARY OF AMERICAN-MARIETTA COMPANY

2128

A RED'S LARGEST MANUFACTURER OF FINELY DIVIDED METALS

For additional information Circle No. 48 on the Reader Service Card

Merriman Bros.
185 Amory St.
Jamaica Plain
Boston 30, Mass.
(helical gears)

Micro Metallic Corp.
30 Sea Cliff Ave.
Glen Cove, N. Y.
(filters)

Precision Metal Products
Commerce St., Box 129
Ellwood City, Pa.
(filters)

STRUCTURAL PARTS

Brass

American Electro Metal Corp.
320 Yonkers Ave.
Yonkers, N. Y.

American Sintered Alloys Div.
Yale & Towne Mfg. Co.
Box J.
Bethel, Conn.

American Tool Works
Powder Metallurgy Div.
132 Allyn St.
Hartford 3, Conn.

Amplex Mfg. Co.
Subsidiary of Chrysler Corp.
6501 Harper
Detroit 31, Mich.

Bound Brook Oilless Bearing Co.
Lincoln Blvd.
Bound Brook, N. J.

Chicago Powdered Metal Products Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Dixon Sintaloy, Inc.
535 Hope St.
Stamford, Conn.

General Powdered Metal Products, Inc.
523 West St.
Norwalk, Conn.

International Powder Metallurgy Co., Inc.
439 W. Main St.
Ridgway, Pa.

Keyston Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Cal.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain
Boston 30, Mass.

Michigan Powdered Metal Products Co., Inc.
466 Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, Ohio

National Molded Products, Inc.
40-42 S. St. Marys St.
St. Marys, Pa.

Parker White-Metal Co.
2153 McKinley Ave.
Erie, Pa.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Presmet Corp.
112 Harding St.
Worcester, Mass.

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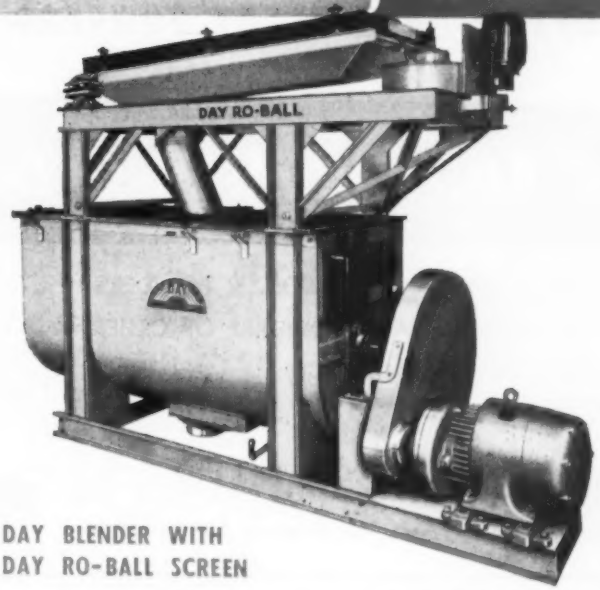
ACCURATE SIZING
PROPER DENSITY
THOROUGH BLENDING

Successful Powder Metallurgy



DAY BLENDER WITH
DAY RO-BALL SCREEN

Successful powder metallurgy depends on accurate sizing of metal particles, proper density of the compact and thorough blending to insure homogeneous structure. The DAY Blender, teamed with the DAY Ro-Ball Screen, meets all three of these vital requirements.

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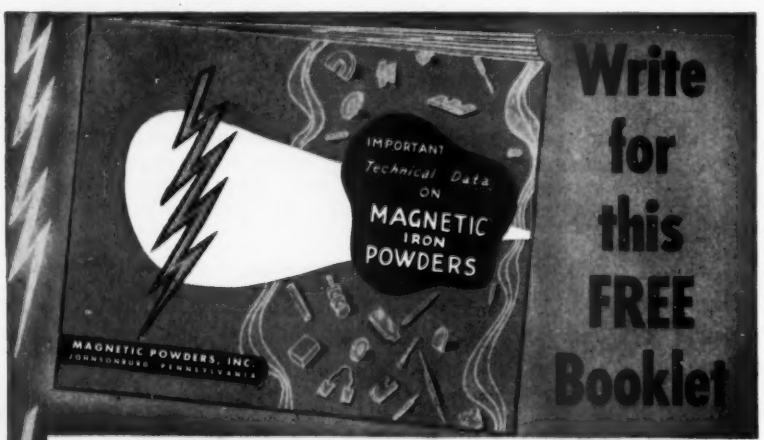

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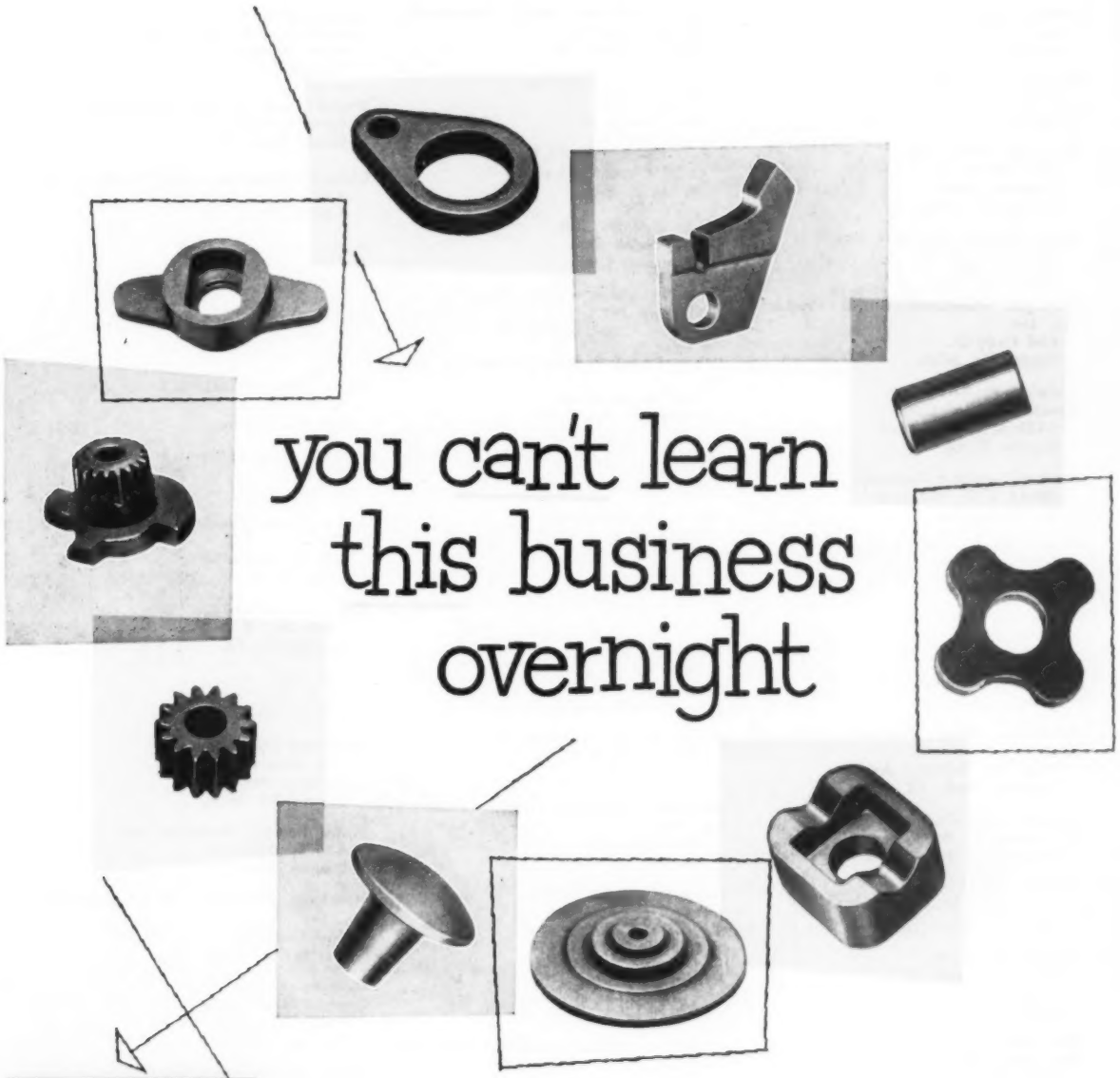

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Sintered Metals, Inc.
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Jamaica Plain
Boston 30, Mass.

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Div. Ferro, Inc.
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Boston 30, Mass.

Thompson Products, Inc.
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STRUCTURAL PARTS

Iron base, infiltrated

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...high tensile strength

*50% Chromium—50% Nickel Alloy powder combined with 1% Graphite and electrolytic iron powder.

Tensile strength psi 121,000

(Sintered 2 hrs. at 1200°C.)

Sintered density	**6.97**
Elongation % in 1"	**2.5**
Rockwell Hardness	**B-99**

Multiple advantages accrue to you through the use of MH Chrome Nickel alloy powders for Alloy Steel compositions in your powder metallurgy molding —

- volume production of intricate parts, having higher tensile strength
- miniaturization of parts with greater strength and less mass
- no scrap or waste, no milling or finishing required

Fine particle size is an outstanding feature of MH Chrome Nickel alloy powders, as indicated on the chart below.

COMPARISON OF EFFECTS OF HEAT TREATMENT ON PROPERTIES OF ELECTROLYTIC IRON POWDER PLUS ALLOYS OF VARIED NICKEL—CHROMIUM CONTENTS

Compacting Pressure — 50 t/s
Sintering Condition — 1100°C for 1 hour at temperature in hydrogen

MATERIAL

	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Ni — 20% Cr) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G/CC
Sintered	72200	2.5	Rb83	7.11
Coined	76300	4.6	Rb85	7.18
Coined & Annealed	71000	3.5	Rb84	7.15
Coined & Quenched	76900	1.7	Rc25	7.08
Coined, Quenched & Annealed	99500	0.5	Rc35	7.08
Quenched	75800	2.1	Rc29	7.11
Quenched & Annealed	88650	2.3	Rc26	7.11

	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Cr — 20% Ni) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G/CC
	66100	2.0	Rb99	6.64
	63000	2.0	Rb95	6.65
	83000	2.0	Rb95	6.65
	84400	2.0	Rb100	6.65
	92900	2.0	Rb96	6.65
	84000	2.0	Rb97	6.65
	77300	2.0	Rb95	6.65

SIZE CHARACTERISTICS

(80% Ni — 20% Cr)	
+ 100	2.4%
100 + 200	31.9%
200 + 325	28.5%
− 325	37.2%

(80% Cr — 20% Ni)	
100 + 200	4.7
200 + 325	9.7
325	85.6

(50% Cr — 50% Ni)	
+ 100 mesh	0.8%
100 + 150	4.5
150 + 200	8.9
− 200 + 270	11.0
− 270 + 325	12.2
− 325	62.6

Apparent Density g/cc By Scott Volumeter 1.89

For detailed information, write:

METAL HYDRIDES INC.

20 CONGRESS STREET · BEVERLY · MASS.

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Spartanburg, S. C.
(nickel silver)

Powdered Metal Products Corp. of America
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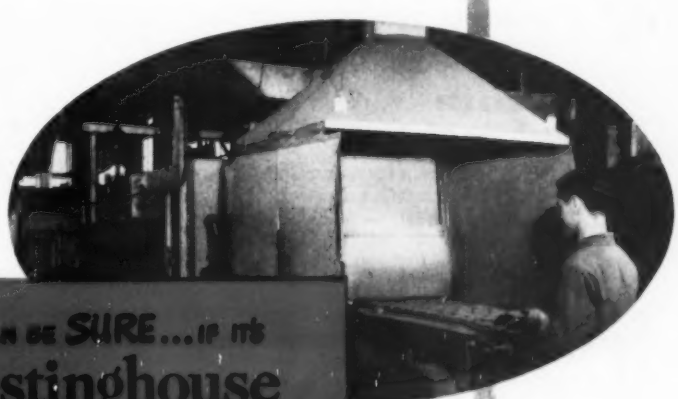

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HEAT-TREATING FURNACES

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Sunbeam Corporation
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EF

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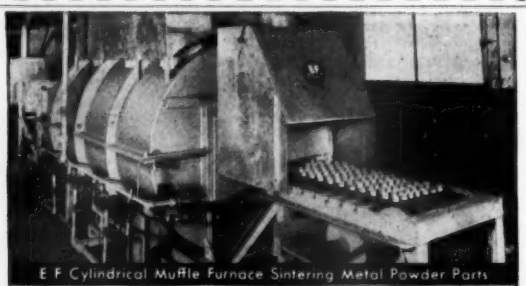
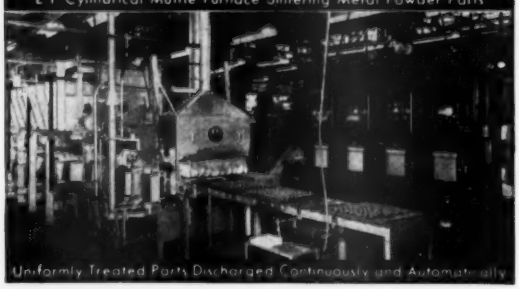


E F Cylindrical Muffle Furnace Sintering Metal Powder Parts



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For additional information Circle No. 90 on the Reader Service Card

FURNACES, ELECTRIC
Controlled atmosphere, batch

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Drever Company
736 E. Venango St.
Philadelphia 34, Pa.

Electric Furnace Co.
Salem, Ohio

Harper Electric Furnace Corp.
39 River St.
Buffalo 2, N. Y.

C. I. Hayes, Inc.
75 Baker St.
Providence 5, R. I.

Hevi Duty Electric Co.
4212 W. Highland Blvd.
Milwaukee 1, Wisc.

Holcroft & Company
6545 Epworth Blvd.
Detroit 10, Michigan

Leeds & Northrup Co.
4970 Stenton Ave.
Philadelphia, Pa.

Lindberg Engineering Co.
2450 W. Hubbard St.
Chicago 12, Ill.

Pereny Equipment Co.
893 Chambers Road
Columbus 12, Ohio

Sargeant & Wilbur, Inc.
180 Weeden St.
Pawtucket, R. I.

The Sentry Company
66 Main St.
Foxboro, Mass.

Sunbeam Stewart Industrial Furnace Div.
Sunbeam Corp.
4433 W. Ogden Ave.
Chicago 23, Ill.

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.

FURNACES, ELECTRIC
Controlled atmosphere, continuous

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Drever Company
736 E. Venango St.
Philadelphia 34, Pa.

Electric Furnace Co.
Sa'em, Ohio

Harper Electric Furnace Corp.
39 River St.
Buffalo 2, N. Y.

C. I. Hayes, Inc.
75 Baker St.
Providence 5, R. I.

Hevi Duty Electric Co.
4212 W. Highland Blvd.
Milwaukee 1, Wisc.

Holcroft & Company
6545 Epworth Blvd.
Detroit 10, Mich.

Lindberg Engineering Company
2450 W. Hubbard St.
Chicago 12, Ill.

Pereny Equipment Co.
893 Chambers Rd.
Columbus 12, Ohio

Sargeant & Wilbur, Inc.
180 Weeden St.
Pawtucket, R. I.

Sunbeam Stewart Industrial Furnace Div.
Sunbeam Corporation
4433 W. Ogden Avenue
Chicago 23, Ill.

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Dissociated ammonia

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Drever Company
736 E. Venango St.
Philadelphia 34, Pa.

Electric Furnace Co.
Salem, Ohio

C. I. Hayes, Inc.
75 Baker St.
Providence 5, R. I.

Hevi Duty Electric Co.
4212 W. Highland Blvd.
Milwaukee 1, Wisc.

Lindberg Engineering Co.
2450 W. Hubbard St.
Chicago 12, Ill.

Sargeant & Wilbur, Inc.
180 Weeden St.
Pawtucket R. I.

Surface Combustion Corp.
Toledo 1, Ohio

For additional information Circle No. 104 on the Reader Service Card

Pyron Corporation

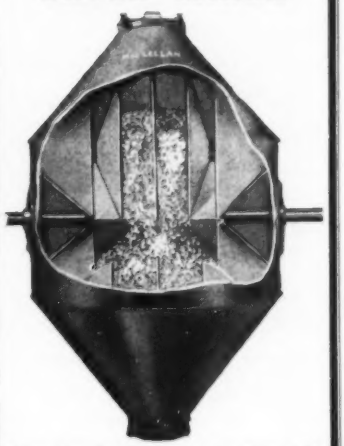
Producers of

HYDROGEN REDUCED
IRON POWDER

Niagara Falls, N. Y.

An Accurate Mix In One Minute!

MacLELLAN BATCH MIXER



Capacities from 5 quarts to 160 cubic feet. Write for details, stating mixing problem.

ANGLO-AMERICAN MILL SALES CO, INC.
Owensboro, Kentucky

Circle No. 122 on the Reader Service Card

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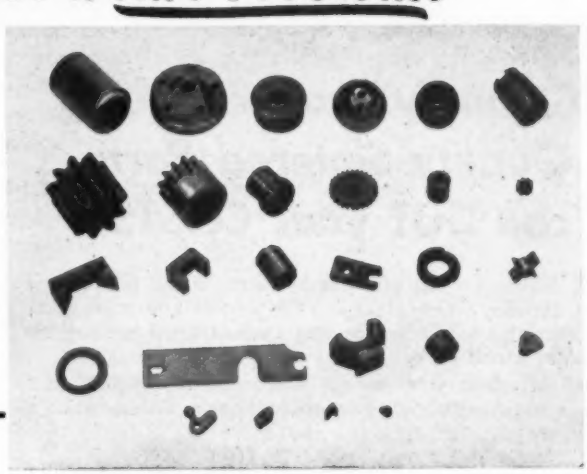

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Save time, money and machining operations by using Metal Powder Parts. We work to close tolerances and are equipped to engineer and produce a variety of shapes in materials tailored to your requirements . . . fast and at reasonable cost.

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No obligation, of course.

Metal Powder Products, Inc.

413 W. Fifth St. **Phone Michigan 0396** **Dayton 2, Ohio**

For additional information Circle No. 108 on Reader Service Card

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Partially combusted natural or artificial gas

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Electric Furnace Co.
Salem, Ohio

C. I. Hayes, Inc.
75 Baker St.
Providence 5, R. I.

Hevi Duty Electric Co.
4212 W. Highland Blvd.
Milwaukee 1, Wisc.

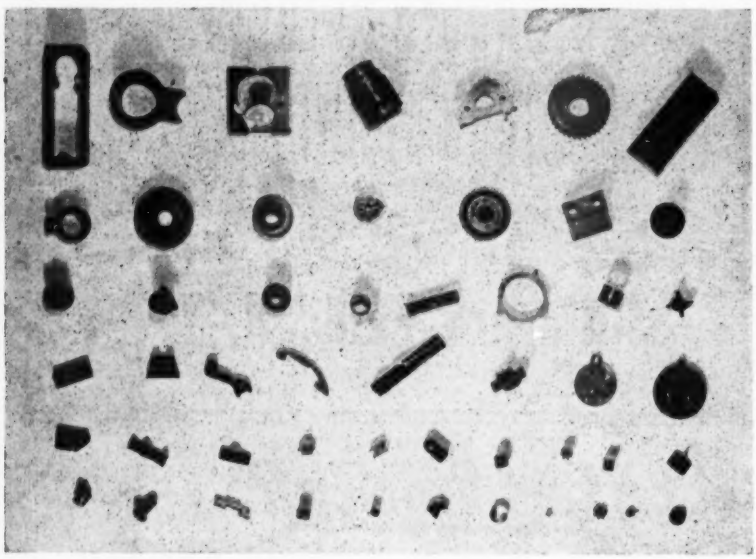
C. M. Kemp Mfg. Co.
405 E. Oliver St.
Baltimore 2, Md.

Lindberg Engineering Company
2450 W. Hubbard St.
Chicago 12, Ill.

Sargeant & Wilbur, Inc.
180 Weeden St.
Pawtucket, R. I.

Surface Combustion Corp.
Toledo 1, Ohio

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.



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Also tells how you can get a comprehensive Cost and Engineering Analysis of your problem parts, without charge or obligation.

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For additional information Circle No. 64 on the Reader Service Card

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Fully combusted natural or artificial gas

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Electric Furnace Co.
Salem, Ohio

C. I. Hayes, Inc.
75 Baker St.
Providence 5, R. I.

C. M. Kemp Mfg. Co.
405 E. Oliver St.
Baltimore 2, Md.

Lindberg Engineering Company
2450 W. Hubbard St.
Chicago 12, Ill.

Sargent & Wilbur, Inc.
180 Weeden St.
Pawtuckett, R. I.

Surface Combustion Corp.
Toledo 1, Ohio

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Liquid hydrocarbon decomposition

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Electric Furnace Co.
Salem, Ohio

Hevi Duty Electric Co.
4212 W. Highland Blvd.
Milwaukee 1, Wisc.

Westinghouse Electric Corp.
Industrial Heating Dept.
180 Mercer St.
Meadville, Pa.

GAS GENERATORS FOR CONTROLLED ATMOSPHERES

Other

Cardox Corp.
307 N. Michigan Ave.
Chicago 1, Ill.
(low pressure carbon dioxide)

Electric Furnace Co.
Salem, Ohio
(nitrogen)

IMPREGNATING EQUIPMENT

American Metaseal Mfg. Corp.
30 E. 60th St.
New York 22, N. Y.

LUBRICANTS, STEARATES FOR POWDER

American Cyanamide Co.
Industrial Chemicals Div.
30 Rockefeller Plaza
New York 20, N. Y.

Metasap Chemical Co.
Harrison, N. J.

METAL POWDERS

Investigate

for increasing output—

reducing costs—

conserving critical material—

improving product quality

The constantly increasing applications of metal powders in industry for various purposes, the advantages they have achieved and the seemingly unlimited possibilities still to be developed are gaining the attention of more and more design and production engineers. Plastic Metals is the country's largest producer of electrolytic iron powder and has pioneered in the development and production of metal powders for 18 years. Its recently expanded electrolytic, reduction, pulverizing, annealing and screening facilities provide fabricators and users of metal powders one of their most dependable sources for this material.

Plastic Metals produces the following metal powders in a wide variety of grades, featuring high chemical purity; particle size distribution (ranging from 20 mesh to less than 20 microns) to meet requirements; irregularly shaped or spherical particles; range of apparent densities; and, lot-to-lot quality uniformity:

PLAST-IRON—a high quality electrolytic iron powder of extreme purity—ideally suited for electrical, magnetic and high physical property applications.

PLAST-SPONGE—a reduced oxide type of iron powder specially characterized by excellent compressibility and high sintered strength.

PLAST-CORIRON—a grade of iron powder developed specially for the production of television transformer cores. Noted for exceptional permeability and Q values in frequency range of 10 to 100 K.C.

PLAST-NICKEL—a high grade nickel powder with purity ranging from 98% to 99%. Either spherical or irregularly shaped particles can be supplied.

OTHER METAL POWDERS—can be supplied to specification. Likewise, large scale pulverizing, screening and annealing facilities are available for the preparation of a wide variety of substances required in powdered form.

We will be glad to talk with your purchasing, research, or engineering staff concerning metal powder possibilities and limitations—and to put you in touch with reliable and experienced metal powder fabricators for a practical discussion of your particular problems.

PLASTIC METALS

DIVISION OF THE NATIONAL RADIATOR COMPANY
JOHNSTOWN, PENNSYLVANIA

For additional information Circle No. 33 on the Reader Service Card

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Pre-Alloyed

STAINLESS STEEL POWDERS

grades 302-b and 316 promptly available in quantities to meet your needs

Increased production of our Vasco Pre-Alloyed Stainless Steel Powders in Grades 302-B and 316 enables prompt shipment for your immediate requirements.

These unique Pre-Alloyed powders are completely homogeneous in structure—each particle is a representative sample of the melt from which it is made. Uniformity of particle size and shape is carefully controlled.

- excellent green strength
- wide sintering range

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Vanadium-Alloys
STEEL COMPANY
LATROBE, PA.
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.

For additional information Circle No. 37 on the Reader Service Card

MIXING AND BLENDING EQUIPMENT

Double cone mixers

Anglo American Mill Co.
Owensboro, Kentucky

R. N. Bailey & Co., Inc.
11 W. 42nd St.
New York, N. Y.

Brill Equipment Co.
2401 Third Avenue
New York 51, N. Y.

The Stevenson Company
Wellsville, Ohio

MIXING AND BLENDING EQUIPMENT

Spiral flight mixers

R. N. Bailey & Co., Inc.
11 W. 42nd St.
New York, N. Y.

Baker Perkins, Inc.
1000 Hess St.
Saginaw, Michigan

Brill Equipment Co.
2401 Third Ave.
New York 51, N. Y.

J. H. Day Co., Inc.
1144 Harrison Ave.
Cincinnati, Ohio

General Mixing Equipment Co.
413 N. Third St.
Philadelphia 23, Pa.

Read Standard Corporation
York, Pennsylvania

The Stevenson Company
Wellsville, Ohio

MIXING AND BLENDING EQUIPMENT

Other

Baker Perkins, Inc.
1000 Hess St.
Saginaw, Michigan
(continuous mixing and blending equipment)

J. H. Day Co., Inc.
1144 Harrison Ave.
Cincinnati, Ohio
(pony & double arm)

Read Standard Corp.
York, Pennsylvania
(double arm horizontal, vertical planetary)

Sturtevant Mill Co.
103 Clayton St.
Boston 22 (Dorchester), Mass.
(rotary dustless mixers and blenders)

PRESSES, HYDRAULIC

For coining sintered compacts

L. Albert & Son
Trenton, N. J.

American Steel Foundries
Elmes Engineering Division
1150 Tennessee Avenue
Cincinnati 29, Ohio

E. W. Bliss Co.
1375 Raff Rd. S. W.
Canton, Ohio

Brill Equipment Co.
2401 Third Avenue
New York 51, New York

Kux Machine Co.
6725 N. Ridge
Chicago, Ill.

Lake Erie Engineering Corp.
P. O. Box 68, Kenmore Station
Buffalo 17, N. Y.

Loomis Engineering & Mfg. Co.
124 S. 14th St.
Newark 7, N. J.

Standard Machinery Co.
351 Indiana Ave., N. W.
Grand Rapids 4, Michigan.

F. J. Stokes Machine Company
5500 Tabor Road
Philadelphia 20, Pa.

PRESSES, HYDRAULIC

For forming green compacts

L. Albert and Son
Trenton, N. J.

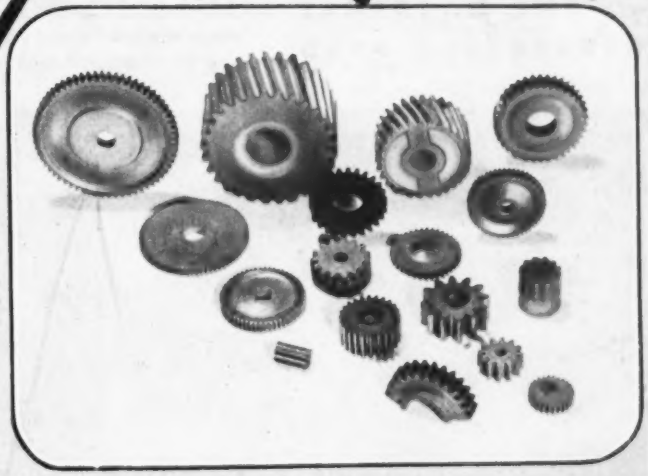
American Steel Foundries
Elmes Engineering Division
1150 Tennessee Avenue
Cincinnati 29, Ohio

Baldwin-Lima-Hamilton Corp.
Philadelphia 42, Pa.

E. W. Bliss Co.
1375 Raff Rd. S. W.
Canton, Ohio

Brill Equipment Co.
2401 Third Avenue
New York 51, N. Y.

Geared to Variety



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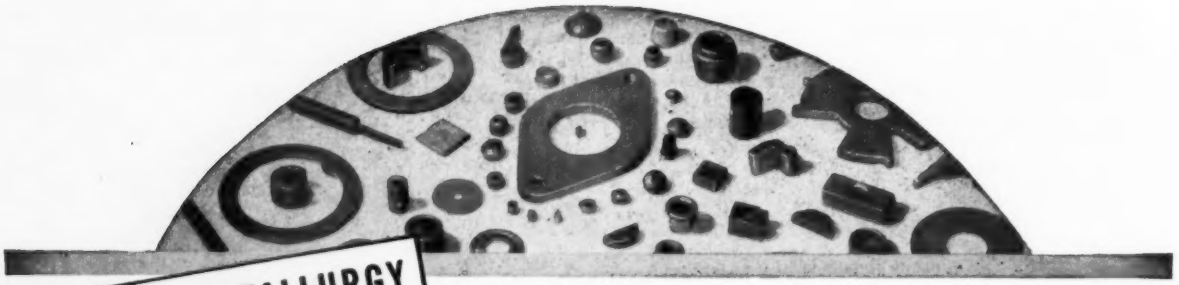
For additional information Circle No. 73 on the Reader Service Card



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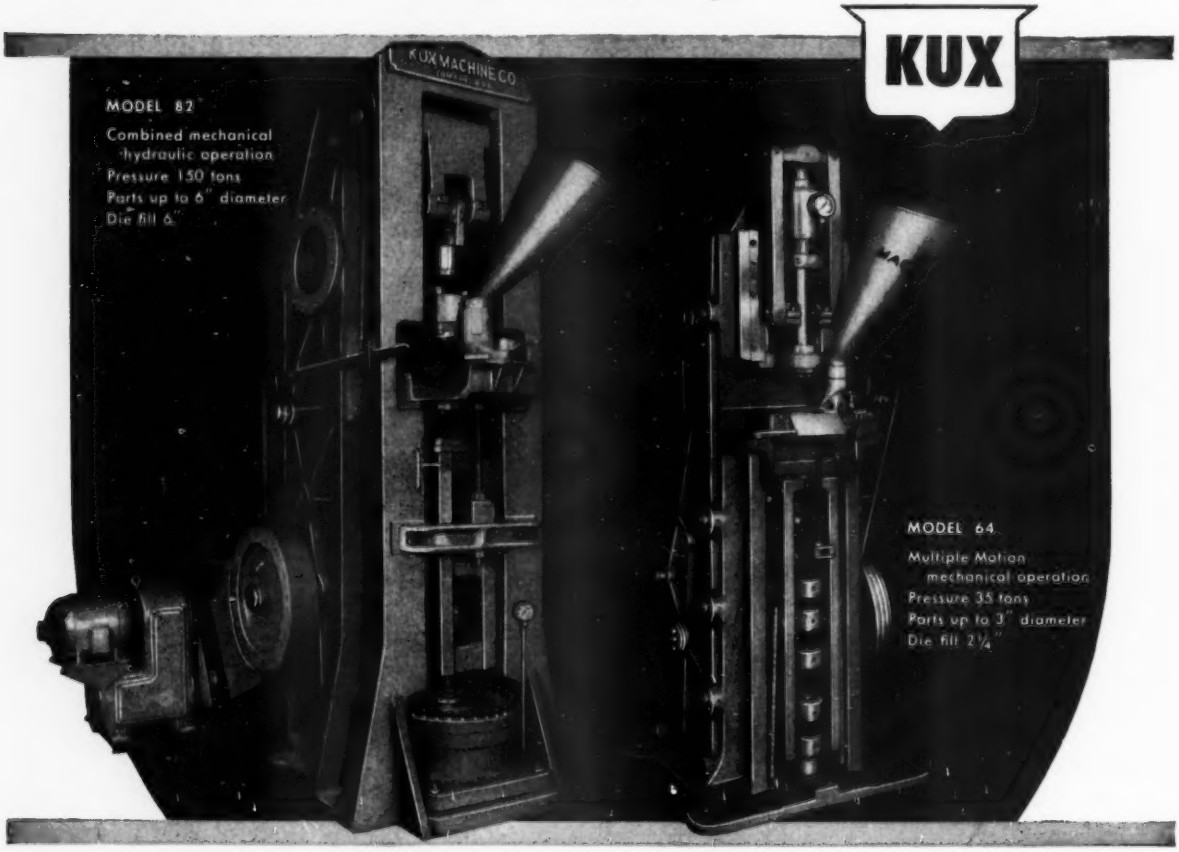

KUX MACHINE COMPANY
6725 N. RIDGE • CHICAGO 26, ILLINOIS

For additional information Circle no. 26 on the Reader Service Card

Arthur Colton Co.
3400 E. Lafayette
Detroit 8, Michigan

Kux Machine Co.
6725 N. Ridge
Chicago, Ill.

Lake Erie Engineering Corp.
P. O. Box 68, Kenmore Station
Buffalo 17, N. Y.

Loomis Engineering & Mfg. Co.
124 S. 14th St.
Newark 7, N. J.

Standard Machinery Co.
351 Indiana Ave., N. W.
Grand Rapids 4, Mich.

F. J. Stokes Machine Company
5500 Tabor Road
Philadelphia 20, Pa.

PRESSES, MECHANICAL
For coining sintered compacts

L. Albert & Son
Trenton, N. J.

E. W. Bliss Company
1375 Raff Rd. S. W.
Canton, Ohio

Brill Equipment Co.
2401 Third Avenue
New York 51, N. Y.

Kux Machine Co.
6725 N. Ridge
Chicago, Ill.

F. J. Stokes Machine Co.
5500 Tabor Road
Philadelphia 20, Pa.

PRESSES, MECHANICAL
For forming green compacts

Baldwin-Lima-Hamilton Corp.
Philadelphia 42, Pa.

E. W. Bliss Company
1375 Raff Rd., S. W.
Canton, Ohio

Brill Equipment Co.
2401 Third Avenue
New York 51, N. Y.

Arthur Colton Company
3400 E. Lafayette
Detroit 8, Michigan

Kux Machine Co.
6725 N. Ridge
Chicago, Ill.

F. J. Stokes Machine Company
5500 Tabor Road
Philadelphia 20, Pa.

SCREENING EQUIPMENT
Industrial

R. N. Bailey & Co., Inc.
11 W. 42nd St.
New York, N. Y.
(gyrating)

Brill Eqipment Co.
2401 Third Avenue
New York 51, N. Y.

J. H. Day Co., Inc.
1144 Harrison Ave.
Cincinnati, Ohio
(gyrating, vibrating and brush)

The Exolon Company
Tonawanda, N. Y.
(multideck industrial)

B. F. Gump Co.
1325 S. Cicero Ave.
Chicago 50, Ill.

Link Belt Company
2045 W. Hunting Park Ave.
Philalelphia 40, Pa.

Mercer-Robinson Co.
30 Church St.
New York 7, N. Y.
(gyro)

Robins Conveyors Div.
Hewitt-Robins, Inc.
270 Passaic Ave.
Passaic, N. J.

Sturtevant Mill Co.
103 Clayton St.
Boston 22 (Dorchester), Mass.
(vibrating screens and air separators)

W. S. Tyler Co.
3615 Superior Ave.
Cleveland 14, Ohio

SCREENING EQUIPMENT
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11 W. 42nd St.
New York, N. Y.
(gyrating)

Brill Equipment Co.
2401 Third Ave.
New York 51, N. Y.

The Exolon Company
Tonawanda, N. Y.
(4 deck laboratory)

B. F. Gump Co.
1325 S. Cicero Ave.
Chicago 50, Ill.

Robins Conveyors Div.
Hewitt-Robins, Inc.
270 Passaic Ave.
Passaic, N. J.

W. S. Tyler Co.
3615 Superior Ave.
Cleveland 14, Ohio

OTHER

Federal Classifier Systems, Inc.
127 N. Dearborn St.
Chicago 2, Ill.
(Air separators)

Loomis Engineering & Mfg. Co.
124 S. 14th St.
Newark 7, N. J
(laboratory presses)

The Stevenson Company
Wellsville, Ohio
(laboratory jar and ball mills, production pebble mills)

F. J. Stokes Machine Company
5500 Tabor Road
Philadelphia 20, Pa.
(vacuum sintering furnaces)

POWDER SUPPLIERS

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Pittsburgh, Pa.

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Brooklyn 7, N. Y.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

Reynolds Metals Co.
2500 S. 3rd St.
Louisville, Ky.

BRASS

American Metal Co., Ltd.
61 Broadway
New York 6, N. Y.

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Greenback Industries
Greenback, Tenn.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

New Jersey Zinc Co.
160 Front St.
New York 38, N. Y.

Reynolds Metals Co.
2500 S. Third St.
Louisville, Ky.

COPPER

American Metals Co., Ltd.
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New York, N. Y.

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320 Belmont Ave.
Brooklyn 1, N. Y.

Glidden Company
Chemical & Pigment Div.
1396 Union Commerce Bldg.
Cleveland 14, Ohio

Greenback Industries
Greenback, Tenn.

Chas. Hardy, Inc.
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Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

New Jersey Zinc Co.
160 Front St.
New York 38, N. Y.

George R. Smith Co., Ltd.
448 S. Hill St.
Los Angeles 13, Cal.

IRON

Antara Chemical Div.
General Dyestuffs Corp.
435 W. Hudson St.
New York 14, N. Y.
(Carbonyl iron only)

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320 Belmont Ave.
Brooklyn 1, N. Y.

Easton Metal Powder Co.
900 Line St.
Easton, Pa.

Ekstrand & Tholand, Inc.
441 Lexington Ave.
New York, N. Y.

Ferrum, Ltd.
106 Ste. Madeleine Bld.
Cap de la Madeleine
Quebec, Can.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

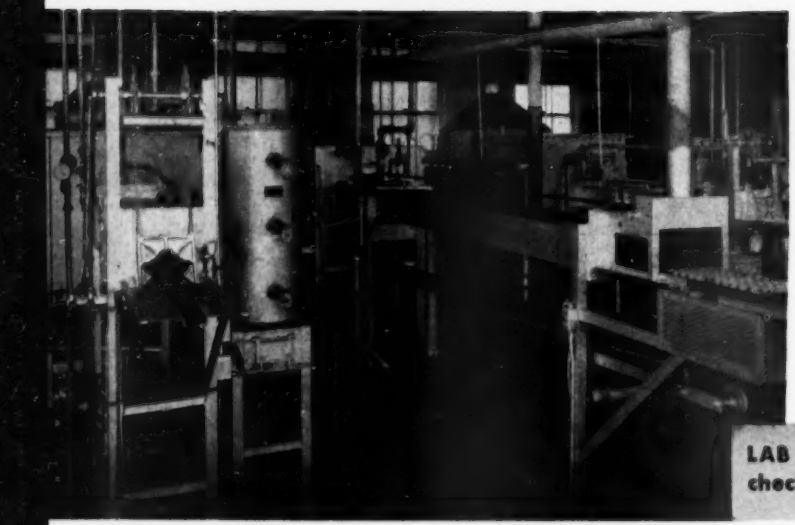
Hoeganaes Sponge Iron Corp.
545 Fifth Ave.
New York 17, N. Y.

Magnetic Powders, Inc.
Fairview Ave.
Johnsonburg,, Pa.

"Sintering critical items for U.S. Govt. contracts our Hayes Furnaces meet every requirement,"

says Andy Wayson, Manager
Powdered Metal Div., Merriman Bros., Inc.

Merriman Bros. recently expanded Powder Metal Department now has in operation 10 units of Hayes equipment of various types, covering the complete range of sintering powder metal compacts.



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Metal Powders, Ltd.
73 Fifth Ave.
Iberville, Quebec, Can.
Plastic Metals Div.
The National Radiator Corp.
195 Bridge St.
Johnstown, Pa.
Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.
Vanadium Alloys Steel Co.
Latrobe, Pa.

TIN

American Metals Co., Ltd.
61 Broadway
New York, N. Y.
Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.
Greenback Industries
Greenback, Tenn.
Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.
Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.
Malone Metal Powders, Inc.
220 West 42nd St.
New York 36, N. Y.
Metal Powders, Ltd.
Iberville, Quebec, Can.
Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.
Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.
Plastic Metals Div.
The National Radiator Corp.
195 Bridge St.
Johnstown, Pa.
Pyron Corp.
P. O. Box 246 LaSalle Sta.
Niagara Falls, N. Y.
George R. Smith Co., Ltd.
448 S. Hill St.
Los Angeles 13, Cal.

LEAD

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.
Glidden Company
Chemical & Pigment Div.
1396 Union Commerce Bldg.
Cleveland 14, Ohio
Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.
Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.
National Lead Co.
111 Broadway
New York 6, N. Y.

NICKEL

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.
Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.
Metals Disintegrating Co.
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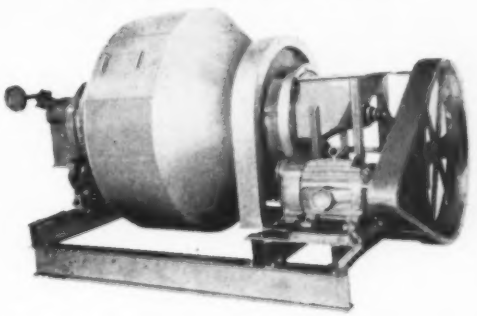

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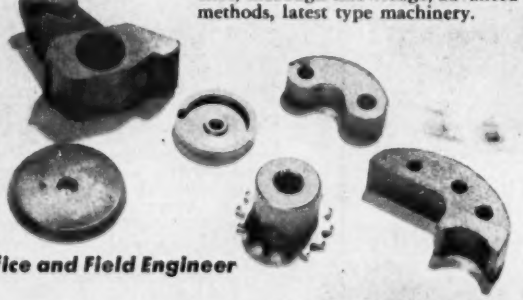

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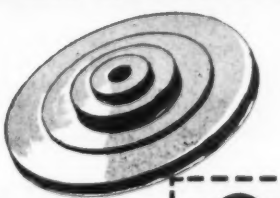

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PERMANENT MOLD CASTINGS
continued from page 54

finishing operation, the possibility of openings between the skin and the frame made sterilization difficult. The amount of machining on such a head rest was as great as on a sand casting and required similar fixtures.

A permanent mold cast head rest eliminated substantially all of the objectionable features of the other methods of manufacture. Such a rest is shown in Figure 1. To secure all of the required rigidity, light ribbing is incorporated in the underside. The pivot holes are cored with sufficient accuracy so that at most, a light reaming operation is all that is required. The bosses are accurately positioned with locating points marked for subsequent drilling and tapping. In some cases, a cleanup cut in the slot between the bosses is required, mostly for flash removal.

In the polishing of a permanent mold cast head rest, the initial surface is sufficiently good so that only a very light sanding operation is needed before actual polishing is started. As a result, the cast skin is never broken, so that even if some sub-surface porosity is present, it is not exposed and, from a finishing point of view, is non-existent.

Considering the reduction in machining costs, the lowered tooling costs and the lower finishing costs, there is a marked reduction in the final piece price. One, or at the most two, inspections are all that are now needed and rejects are practically eliminated.

Finishing of the head rest is simply by polishing and anodizing since, being of aluminum, no plating is required. The sequence of finishing operations after any initial light sanding that may be required is:

1. Buff on a hard canvas wheel loaded with 120 grit Tripoli in grease.
2. Buff on a sewed muslin finger wheel with 180 grit Turkish emery.
3. Buff on a sewed muslin wheel with 5/8 sewing 3/4 apart. Lea compound containing 180 grit silicon carbide and a lime nickel finisher is used as the polishing media.
4. Buff on a soft wheel using fine Tripoli.
5. Dry buff on a soft wheel with a lime finisher.
6. Clean by a five second dip in 5 percent sodium hydroxide solution at 160 F.
7. Anodize by the Alumilite process.

The above cycle of finishing results in a satin finish that matches, very closely, the finish of the stainless steel table top.

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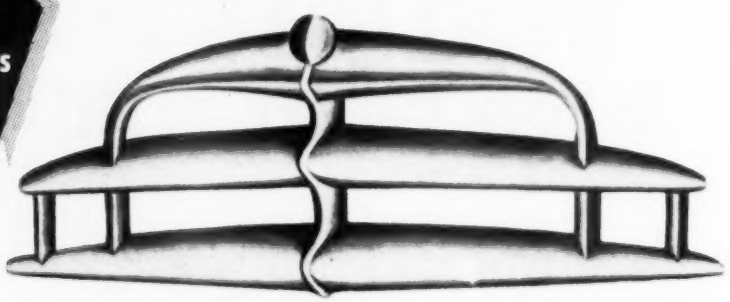

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PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings

How to select compounds for BARREL FINISHING metal parts

By KURT G. O. PINKE*

BARREL finishing is playing an ever increasing part as an aid to the mass production of metal castings, stampings and forgings in modern technology. It is basically a low pressure, random-motion honing process; used to remove heat treat scale, to deburr, or to polish the surface of manufactured parts. Fundamentally, the technique is as follows:

A cylindrical or polysided barrel, which can rotate about its longitudinal axis, is filled to a specified level with an abrading or polishing media, and the parts to be processed. (On occasion no media is used). Water and chemical compounds are added to the load, and the cylinder is then rotated until the desired results are achieved.

It is readily discernible that several factors may be varied in this operation; for example, the type of media used, the level of the load, the size and speed of the cylinder, the type and concentration of the compound used, etc., are all variables. All these factors must be taken into account in order to achieve a desired finish, but it is especially important to choose the correct compound, and to use it properly, to obtain optimum results.

It is the intent herein to aid the operator in the judicious choice of compounds, and to instruct him in their proper use, so that the best results may be attained from his equipment. It will also give him simple methods for analyzing these compounds, in order to determine their primary ingredients, which will help him choose the best compounds from the many on the market.

Barrel finishing compounds may be classified into five general types as follows:

A. Abrasive compounds
B. Deburring compounds
C. Burnishing and coloring compounds
D. Degreasing compounds
E. Scale and rust removal compounds

Each of these groups of compounds must have certain cleaning, cutting or polishing properties, so that it may perform the function for which it is designed. These special characteristics are obtained by the use of several ingredients in each compound with each constituent contributing a necessary property to the mixture as a whole.

The scientifically compounded materials of today are greatly different from the old burnishing soaps of yesterday, and it behooves today's barrel

QUALITY CONTROL of barrel finishing compounds starts in the laboratory. The processor of metal parts can learn much from his supplier of equipment concerning proper materials, process cycles and techniques.

*Metal Finishing Research Engineer, Honite Div., Minnesota Mining & Mfg. Co.

finishing operator to be aware of this, and choose his compounds accordingly. He cannot haphazardly pick any soap or detergent, and expect to achieve reasonably good results from them. In some few instances, of course, a soap or a detergent alone may perform satisfactorily, but in the largest percentage of cases this is not so.

Often the operator is concerned about the inadequacy of his results, and lays his failure to everything except the right cause — the use of an incorrectly designed barrel finishing compound. Here is an examination of each of the various types of compounds. Simple analytical procedures are given later for the detection of the various ingredients mentioned.

Abrasive compounds

The abrasive compounds are generally designed to cut or abrade the surface of metal parts. They will help smoothen the overall surface irregularities, and the ordinary skin effect or chill normally perceived in die castings, forgings, rough machinings, etc. The abrasion or "grinding" process is often preparatory to a subsequent burnishing procedure. These compounds are also sometimes used as deburring compounds. The two are quite similar except for the lack of abrasive in the latter.

Abrasive compounds should at least contain:

1. A non-lubricating detergent

The cleaning action of this group should be obtained from a synthetic detergent and not a lubricating soap. It is not desirable to have lubricating materials as ingredients, because they will act to slow down the cutting action of both the chips and the abrasive material used in this type of compound.

2. An abrasive material

As an accessory to the abrasive chips, a hard fine abrasive substance should be present in the compound to supply supplemental cutting. Usually this is aluminum oxide, carborundum, garnet or quartz fines.

Care must be taken in using abrasive compounds on the lighter and softer metals such as zinc or aluminum, because an aluminum oxide or carborundum-containing compound will cause undesirable darkening of the surface, which is exceedingly difficult to remove by further treatment. A compound containing a nearly colorless abrasive, such as quartz, would be proper for these light metals. For harder metals, e.g. heat treated iron or steels, it is better to use the faster cutting compounds containing aluminum oxide or carborundum, because surface darkening is usually not a problem.

3. A rust-inhibiting chemical

Rusting takes place very easily in most ferrous metals unless a moderately highly alkaline material, or other rust inhibiting chemical is added. The usual materials added to prevent rusting may be borax, soda ash or sodium chromate, although there are a great many others which can be used for this function.

These are the bases for most good surface cutting compounds. This group may contain other ingredients of one kind or another, but in general other additives may be considered extraneous.

The proper use of abrasive materials is as important as the proper choice of compound. This type of compound should be used with very low water level. A slurry should be made in a pail, adding compound to water until a mixture equivalent to a "slushy soup" is obtained. This is the correct consistency for this class of material, if it is to be used as a surface abrader. Just sufficient "soup" is added to the load, so that the chips and

continued on page 97

ADEQUATE RINSING of media and parts between abrasive and burnish runs is a requisite for good surface finish. Rinsing operation is illustrated here.

BARREL FINISHING is a versatile method for applying an almost unlimited range of surface finishes to metal parts on a mass production basis.

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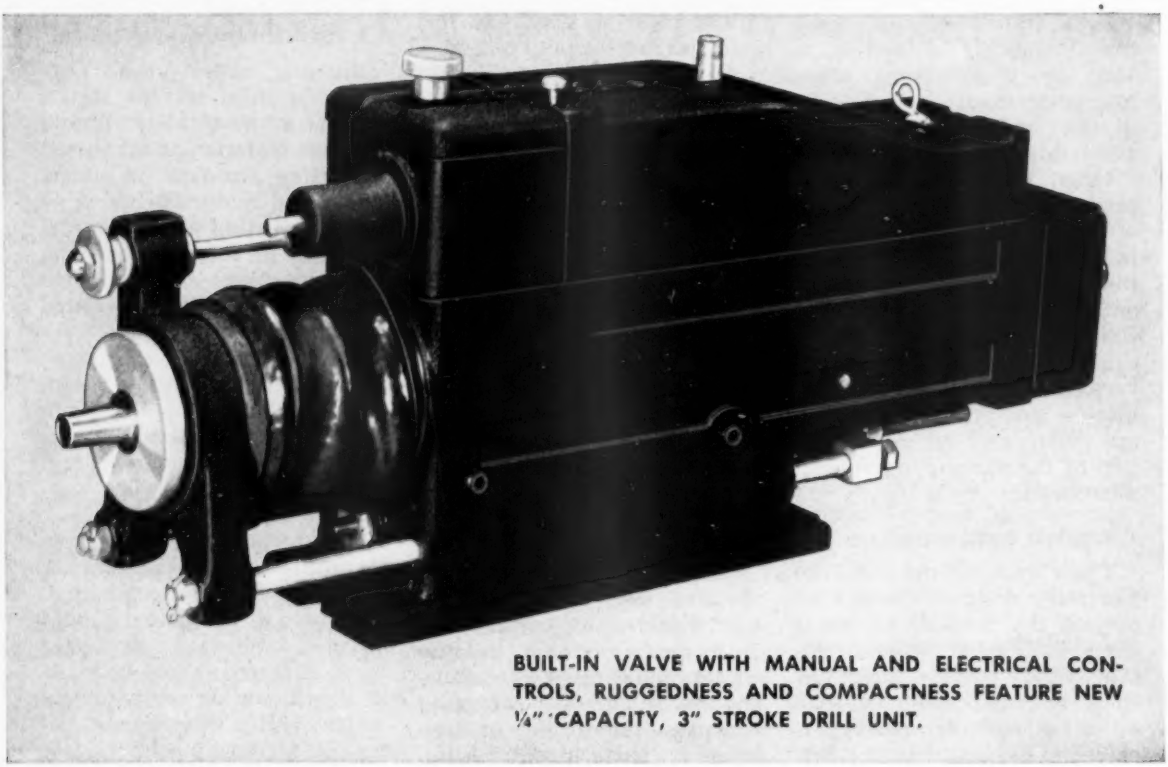

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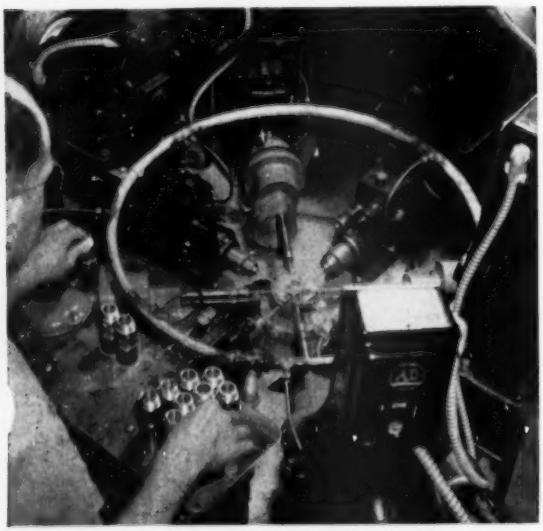

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As standard, the unit is equipped with built-in directional air valve with built-in solenoid, as well as manual start and stop controls. It is available with optional electric controls to provide deep hole drilling with automatic drill cleaning, or time controlled dwell. The Bellows-Locke Drill Unit can be factory equipped with any standard tapping head.

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parts are thoroughly coated with the mixture after a few revolutions of the barrel.

These compounds may also be used as deburring compounds as well. They are then properly used with a higher water level, i.e., 2 to 4 inches below the load level.

Deburring compounds

The deburring compounds are designed to aid the media in removing machining burrs or casting flash. These compounds do not in themselves contribute directly to the deburring process in the manner that abrasive compounds aid in surface finishing. They act merely to keep the parts clean. and in the negative capacity of not inhibiting the abrasive chips from a deburring action.

In general the analysis should be at least as follows:

1. A soap or synthetic detergent

A soap or synthetic detergent aids in cleaning and rinsing, but the amount contained in this type of compound should be a relatively small percentage, so that the viscosity of the solution will not become too high, and so a minimum of lubrication takes place. A high viscosity would inhibit the mass movement of the load with a consequent lessening of the deburring action, and a resultantly prolonged cycle.

2. An alkalinity control chemical

The alkalinity or acidity of a compound is an important factor in preventing a surface color degeneration Often the surface color is an unimportant consideration in a deburring process, but if subsequent burnishing is to be done it may be difficult to remove an undesirable film that has been allowed to deposit by an improperly designed deburring compound.

The pH of these compounds vary from 8 to 10. It should be no higher; for while the compound may work on many metals, there are some with which an unfavorable surface reaction may take place. This is especially true of the lighter metals, such as aluminum, magnesium or zinc. For ferrous metals the higher pH of about 10 is desirable, since it acts as a rust inhibitor for work in the barrels.

3. A chemical cleansing agent other than soap or synthetic detergent

The primary cleansing agent should be a material like borax. This has the twofold action of working as a cleaning agent, while retaining solution fluidity. It also performs as a buffer, so that the alkalinity of the solution will not be greatly changed by the intro-

continued next page

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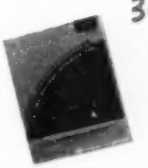

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duction of small amounts of acids or alkalies present in the water supply, or on the media from previous improper cleansing.

The correct use of deburring materials can shorten the time of the run considerably. Usually a low water level is used with this type of compound — from 2 to 4 inches below the load level, and just enough compound is used to keep the work clean. This is usually from ½ ounce to 3 ounces per gallon of water used.

It is understandable that the compound-water ratios given herein are generalizations, and it is advisable to follow the manufacturers recommendations for the proper usage of his specific product.

Burnishing and coloring compounds

In the strictest sense, burnishing and coloring are not synonymous terms. Prior to the introduction of barrel finishing as a science instead of an art, the barrel finisher used two separate runs to obtain, first, a burnish or smooth surface and, secondly, a color or "surface purification" of his metal parts. Modern chemical technology has been able to combine these two operations into one by the use of suitably prepared compounds.

The burnishing and coloring process is not quite as simple as are the abrading or deburring procedures. In this operation it is necessary to take into account the kind of metal being finished. This does not mean that for every metal a special compound must be used, but it does indicate, for example that the most suitable compound for ferrous metals is not always the best compound for use on zinc or brass.

The metal finishing engineer has classified these metals into, roughly, three groups, according to their surface reactivity to various chemicals. These groups are:

1. Ferrous metals
2. Copper and its alloys, i.e., brasses and bronzes
3. The "light" metals like aluminum, zinc and magnesium and their alloys.

Each of these groups of metals requires a specific type of compound to obtain the best burnish and color. It is true that general purpose burnishing compounds are available which "work" for all these groups, but they are not completely satisfactory because optimum finish is usually not obtained from them.

In general, the alkalinity or acidity of these compounds must be closely controlled by the proper ingredients so that a discoloration of the metal parts is not a problem. Certain of these compounds also contain viscosity control chemicals to "thicken" the water solution in order to retard the sliding action of the rotating mass and aid in proper burnishing.

The burnishing and coloring compounds can be classified into three general groups.

Ferrous metal burnishing compounds

This group usually contains the following ingredients:

1. A Tallow Base Soap

A tallow base soap with a high titer should be used in this product to give a good volume of suds and to supply slipperyness or lubricitiy to the solution which is necessary for a good burnishing action. A high titer soap usually will give much longer lasting suds and consequent lubricating action because of the slower rate of solubility and resistance to metallic soap scum formation which may deposit on the parts.

2. A Synthetic Detergent

A small amount of synthetic detergent not only will aid in free rinsing of parts, but will help form finer soap suds which gives better surface cleansing. The use of a detergent for suds in this group of compounds is valueless if it is used without a lubricating substance such as soluble soaps or other types of lubricating materials like methyl cellulose, wax emulsions, etc., because detergents, in themselves, do not supply the necessary lubrication.

3. An Alkalinity Control Chemical

It is imperative in ferrous burnishing and coloring to keep the solution alkaline (pH 9-10.5) so that surface decolorization and rusting will not take place. Thus, an additive supplying this necessary characteristic must be used. Usually this is a substance like sodium silicate powder or soda ash which will give the necessary high alkalinity.

4. A Buffer Chemical

In order to maintain the necessary alkaline properties of

continued next page

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write for fact-packed Catalog

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P. O. Box 988—
Phone 3-5378

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For additional information Circle No. 58 on the Reader Service Card

the solution, usually another chemical is added which acts as a buffer. The buffer has the characteristic of acting in conjunction with the alkalinity control chemical absorber for any acid or alkali which may be present as impurities from tap water, parts, or dirty chips and still permit the alkalinity control chemical to keep the solution at its intended pH. This substance is almost always borax, although other substances can be used.

There are certain ferrous compounds which are designed especially for use with stainless steel. These products have special additives to prevent "greying" of stainless steels which cannot be entirely overcome with the usual ferrous burnishing compounds. It is worthwhile investigating these compounds if stainless steels are a particular problem.

Copper, brass and bronze burnishing compounds

This group may be further divided into two kinds — the alkaline type and the acidic type. The alkaline compounds for copper and its alloys are usually the same as the ferrous burnishing compounds except that they are not quite as alkaline. In general, they do not give as high a color as the acidic compounds although the burnish achieved is the same.

The acidic compounds usually give a brighter color than the alkaline compounds because of the cleansing character of the acid present and the burnish achieved is similar to the alkaline type.

A properly designed acidic compound usually contains the following:

1. A Synthetic Detergent

It is necessary to use a synthetic detergent in acidic compounds to supply cleansing because all conventional soaps are decomposed by acids. Not all detergents, of course, are stable in acid solution so that

the correct kind must be chosen which will give the required cleaning action over a period of several hours.

2. An Acidic Material

An acid which is not too strong will help keep the surface of copper alloys free from darkening. Usually the acids used are organic materials such as critic or oxalic acid, although many other kinds are in use. These organic acids will supply the necessary acidity without etching as many inorganic acids may do.

3. A Lubricating Chemical

In order to achieve a good burnish, it is required that the solution in the barrel have lubricating properties. Ordinary synthetic detergents do not supply this lubricity, as do soaps, so that it is necessary to add certain products which will give this property. These can be substances like methyl cellulose, carboxymethylcellulose or wax emulsions which supply soil suspension and viscosity to the water solution as well as provide lubrication.

Other substances may be added which act as "solution purifiers". These solution purifiers act to absorb ion impurities in the water which may discolor the metal surfaces. In most instances, these latter chemicals are not added because of the expense involved, but they are well worth the extra money.

Zinc, aluminum and magnesium burnishing compounds

This group of compounds may contain a great variety of ingredients. There has been continual experimentation with this special type of material because very few compounds of this kind will give satisfactory results with all the metals of this group. Often a slight modification of a zinc alloy may be sufficient to make a given compound incompatable with it and produce a consequent surface darkening. In general, it has been found that the simpler this type of compound remains, the more satisfactory it will be for all the materials on which it may be used. The following is a typical analysis of this group and has been found by experience to work quite well.

1. A High Titer Soap

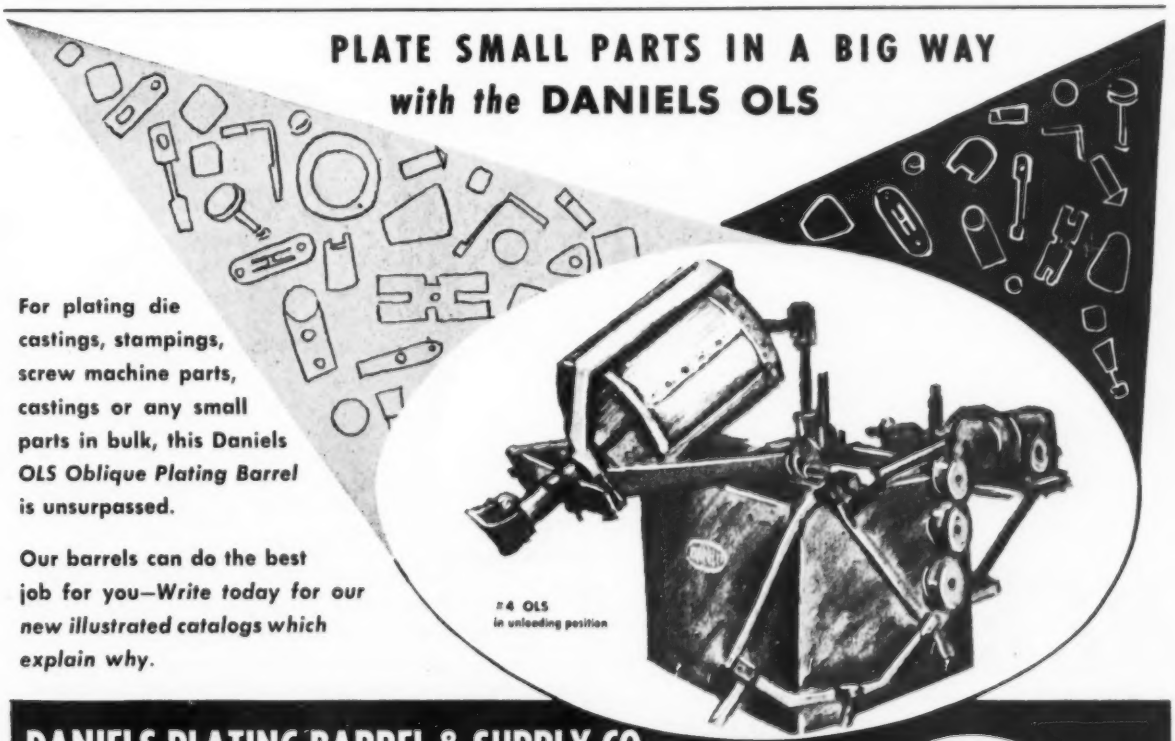
High titer soaps provide the necessary lubricating and cleansing action which is necessary for a good burnish on this group of metals. The high titer soaps, in general, have a very slow breakdown rate, and, thereby, long burnishing runs are possible with consequent low micro inch finishes for the metal surfaces.

2. An Alkalinity Control Chemical

Zinc, aluminum and magnesium alloys require pH's which are just moderately alkaline so that undesirable cor-

continued on page 103

PLATE SMALL PARTS IN A BIG WAY
***with the* DANIELS OLS**



For plating die castings, stampings, screw machine parts, castings or any small parts in bulk, this Daniels *OLS Oblique Plating Barrel* is unsurpassed.

Our barrels can do the best job for you—*Write today for our new illustrated catalogs which explain why.*

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DIVISION OF ALMCO QUEEN STOVE WORKS, INC.

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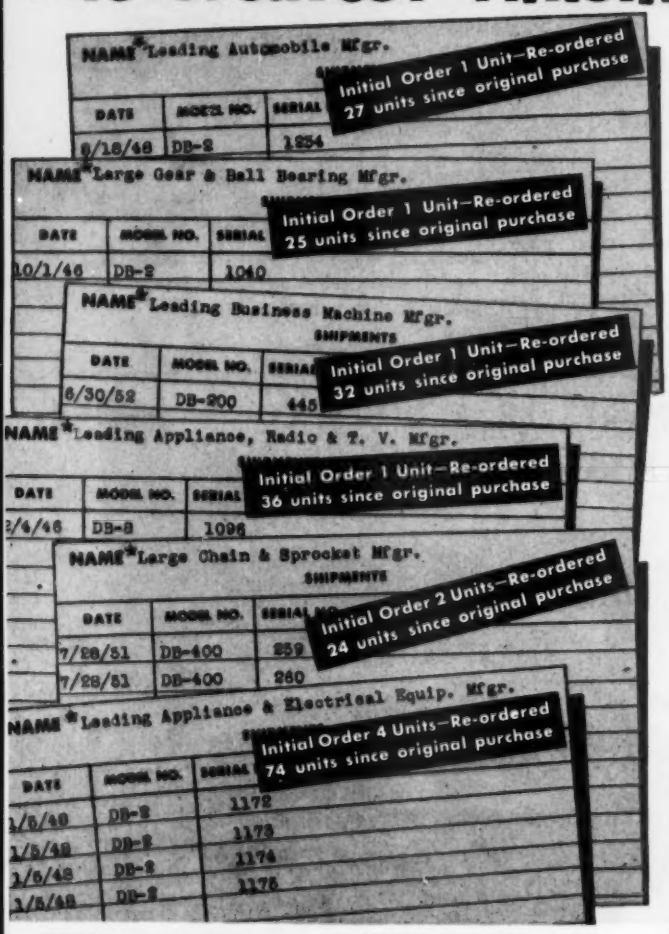
SPEED FINISHING

ALBERT LEA, MINN.

The Greatest Finishing Story Ever Told!


NAME* Leading Automobile Mfg.
DATE | MODEL NO. | SERIAL
9/18/48 | DB-2 | 1254
Initial Order 1 Unit—Re-ordered 27 units since original purchase
NAME* Large Gear & Ball Bearing Mfg.
DATE | MODEL NO. | SERIAL
10/1/46 | DB-2 | 1040
Initial Order 1 Unit—Re-ordered 25 units since original purchase
NAME* Leading Business Machine Mfg.
SHIPMENTS
DATE | MODEL NO. | SERIAL
6/30/52 | DB-200 | 445
Initial Order 1 Unit—Re-ordered 32 units since original purchase
NAME* Leading Appliance, Radio & T. V. Mfg.
DATE | MODEL NO. | SERIAL
2/4/46 | DB-2 | 1096
Initial Order 1 Unit—Re-ordered 36 units since original purchase
NAME* Large Chain & Sprocket Mfg.
SHIPMENTS
DATE | MODEL NO.
7/28/51 | DB-400 | 259
7/28/51 | DB-400 | 260
Initial Order 2 Units—Re-ordered 24 units since original purchase
NAME* Leading Appliance & Electrical Equip. Mfg.
DATE | MODEL NO. | SERIAL
1/5/48 | DB-2 | 1172
1/5/48 | DB-2 | 1173
1/5/48 | DB-2 | 1174
1/5/48 | DB-2 | 1175
Initial Order 4 Units—Re-ordered 74 units since original purchase

THESE CARDS FROM OUR FILES TELL THE STORY! Six years ago Almco Supersheen was a new name in the barrel finishing industry. Today it's the world's most complete and *largest selling* line of barrel finishing equipment and materials. Re-orders from large and small manufacturers have made this remarkable growth possible.

Almost all types of metal parts are now being deburred and finished at sensational cost savings with Supersheen Advanced Speed Finishing.

IN A REVIEW OF 10 TYPICAL ALMCO SUPERSHEEN INSTALLATIONS, finishing costs averaged 80.1% less than former methods—from 48% on a threaded cast iron pipe "T"—to a 95% savings on a steel trigger with intricate configurations.

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rosion will not take place. The pH range for these compounds should be between 7.5 and 8.5, and this may readily be accomplished by the proper combination of substances like borax and boric acid. In most instances, it is not imperative that these additions be made because properly chosen soaps will provide the required pH.

3. A Cleansing Agent Other Than Soap

Often it is desirable to add sbstances such as pine oil which act as cleansing agents and perform as emulsification agents. Emulsions, in general, will give better surface cleansing than a soap alone.

There are many other additives and ramifications possible in this type of compound, and it would be impossible to completely describe this here. Needless to say, the operator should take care that he does not use an acidic compound nor one which is too alkaline because this would give him very severe etching or surface darkening on the zinc-aluminum magnesium group. It is possible to release gases from this group by using acidic compounds with resultant barrel or personnel damage if sufficient pressure is built up.

The proper use of burnishing compounds has been debatable for many years. Some authorities proclaim the use of low water level as more ideal, and others say nothing will do but a high water level. It has been observed from many field tests and laboratory experiments that paradoxically both of these theories are correct. It is correct to use a *low water level* (from three to six inches below the load) for burnishing and coloring, provided that the compound used contains a thickening or viscosity control agent which will cause a "hanging together" of the mass in the barrel and will supply the extra

continued on page 105

AMERICAN CHEMICAL PAINT COMPANY
AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet
Subject: INDEX OF ACP CHEMICALS FOR METAL PRESERVATION AND PAINT PROTECTION

METAL	OPERATION	ACP CHEMICAL
ALUMINUM	*Cleaning*	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Preparation for Painting	"ALODINE" "DURIDINE" "DEOXIDINE"
	Protection from Corrosion	"ALODINE"
BRASS	*Brightening*	"ACP BRIGHT DIP"
	Cleaning	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "CUPROTEK
	Corrosion Prevention	"CUPROTEK"
	Soldering Flux	"FLOSOL"
COPPER, BERYLLIUM, AND COPPER ALLOYS	*Brightening*	"ACP BRIGHT DIP"
	Cleaning	"DEOXIDINE" "DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "CUPROTEK"
	Coating Steel with Copper	"CUPRODINE"
	Corrosion Prevention	"CUPROTEK"
	Scale Modification	"RIDOXINE"
	Soldering Flux	"FLOSOL"
	Stripping Copper Coatings	"ACP COPPER STRIPPING SOLUTION"
GALVANIZED IRON, ZINC, AND CADMIUM	*Cleaning*	"DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Corrosion Proofing	"ZINODINE"
	Paint Bonding	"ZINODINE"
	Phosphate Coating, in Preparation for Painting	"LITHOFORM"
	Soldering Flux	"FLOSOL"
IRON AND STEEL	*Chromate Coating, in Preparation for Painting*	"CROMODINE"
	Cleaning	"ACP RIDOLINES AND RIDOSOLS"
	Cleaning for Painting	"DEOXIDINE" "DURIDINE"
	Coating with Copper	"CUPRODINE"
	Drawing and Extrusion	"GRANODRAW"
	Paint Bonding	"CROMODINE" "DURIDINE" "GRANODINE" "PERMADINE" "THERMOIL-GRANODINE"
	Paint Stripping	"CAUSTIC SODA AND SOLVENT NO. 3"
	Phosphate Coating, in Preparation for Painting	"DURIDINE" "GRANODINE" "PERMADINE" "THERMOIL-GRANODINE"
	Phosphate Coating, to Protect Friction Surfaces	"THERMOIL-GRANODINE"
	Pickling with Inhibited Acids	"RODINE"
	Rust Prevention for Unpainted Iron	"PEROLINE"
	Rust Proofing	"PERMADINE" "THERMOIL-GRANODINE"
	Rust Removal—Brush, Dip, or Spray	"DEOXIDINE"
	Soldering Flux	"FLOSOL"
MAGNESIUM	*Cleaning*	"DURIDINE" "ACP RIDOLINES AND RIDOSOLS"
	Pickling	"RODINE (M-200)"
STAINLESS STEEL	*Cleaning*	"DEOXIDINE"
	Coating with Copper	"CUPRODINE"
	Pickle Polishing	"RODINE"
	Soldering Flux	"FLOSOL"

CHEMICALS ACP PROCESSES

WRITE FOR DESCRIPTIVE FOLDERS ON THE ABOVE CHEMICALS AND FOR INFORMATION ON YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

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when you THINK of FASTENERS think of CENTRAL...

CENTRAL MAKES EVERY TYPE FOR ALL DIE-CASTING ASSEMBLIES!

TYPE "1" THREAD CUTTING

Better for metal where a thread cutting action supercedes thread forming. Type "1" Central Thread Cutting Screws drive with minimum torque to form a perfectly mated thread and a tight fit. Interchangeable with standard machine screws.

TYPE "23" THREAD CUTTING

Note the wide thread cutting slot that works better in softer metals such as aluminum and zinc, or in harder metals where the wide slot affords better cutting advantages.

TYPE "25" THREAD CUTTING

Here the exclusive wide flute cutting slot combines with a specially spaced thread for low driving torque, high resistance to stripping and extra-free cutting action. Ideally suited to soft metals and plastics. Write for full details.

DRIVE SCREW TYPE "U"

TYPE "A" TAPPING SCREWS

Pointed and augur-like, the Central Type "A" Tapping screw pulls and forms thinner (.015" to .050") sheets of metal into a matching threaded section from punched, drilled, or nested holes. Available with slotted, Phillips, clutch or hexagon heads.

TYPE "B" TAPPING SCREWS

Die-pointed and augur-like for thicker metal (.050" to .200"), Central Type "B" Tapping Screws pass through a hole in one piece, form their own threads to lock both parts securely. For porous castings, non-brittle plastics, fibre and asbestos materials.

TYPE "C" TAPPING SCREWS

Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

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lubrication necessary for the more active sliding action of the mass.

On the other hand, should a compound not contain materials which increase the viscosity, it is more desirable to use a *high water level* of four to ten inches above the load.

Degreasing compounds

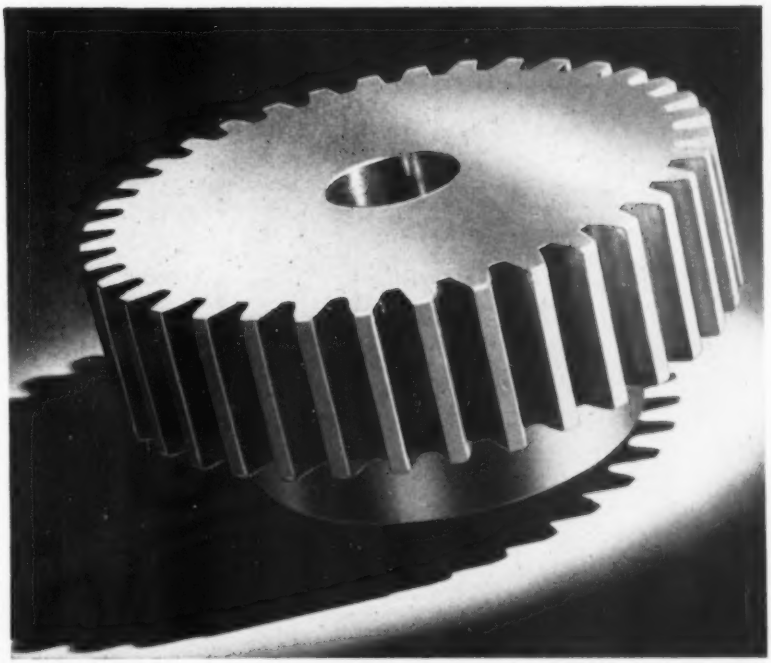
The degreasing compounds are used to remove grease and oil from the parts in a barrel tumbling procedure. They are usually highly alkaline in nature, although this is not imperative. There are several types of degreasing compounds which may be used in a barrel, among them being: (1) emulsion cleaners, (2) emulsifiable solvent cleaners, and (3) the alkaline type cleaners mentioned earlier.

From an economic standpoint, it is best to use only alkaline type cleaners in the barrel, although, in general, they will not do as good a cleaning job as will emulsions or emulsifiable solvents. The alkaline type cleaner will be the only one considered below.

They usually cannot be used with aluminum, zinc or magnesium because of their high pH and the sequential discoloration which they cause. They should contain the following ingredients:

1. A good synthetic detergent or fast dissolving soap to emulsify the greases and oils.
2. An alkaline cleaner, such as soda ash, sodium silicate or borax, to assist the soap in its emulsifying action and act as grease "dissolvers".
3. A peptizing agent so that the heavier greases and oils will first be broken into smaller particles so that the detergent and alkaline cleaner can act upon them. This is accom-

continued on page 118



High lustre finish... faster with

SUPER-HONITE CHIPS!

YES! New Super Honite gives a better finish —*faster*—than any other barrel finishing abrasive. That's because it's the world's *toughest* abrasive chip—engineered for grinding and burnishing to a high luster finish. Does it in jig time, too, because chips don't crumble or pulverize to slow the job.

So remember, for a better finish—in record time—specify Super Honite. No other chip cuts faster—no other chip cuts as long!

TOUGHEST NATURAL CHIP! Use Regular Honite for close tolerance work or minimum removal of metal. No other barrel finishing abrasive—not even granite—retains its edge as long as Regular Honite.

WRITE TODAY for your free copy of "3M Barrel Finishing" . . . it's filled with helpful information for increased efficiency, lower costs. Address Minnesota Mining & Mfg. Co., Dept. PM-43, St. Paul 6, Minnesota.

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Honite BRAND

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3M COMPANY

For additional information Circle No. 127 on the Reader Service Card

NEW PRODUCTS

For additional information on these products circle key number on reader service card bound in this issue.

ABRASIVE BLAST UNIT FOR DIES

FEATURES: Liquid abrasive blast machine designed to clean, finish, burr, blend or etch dies, molds, tools and other parts. Versatility claimed for unit, handling abrasives from 60 to 5000 standard screen size with fast changeover. Size particles, distance between nozzle & work, supply of air pressure can be varied to produce results desired.

SPECIFICATIONS: Liquid slurry is drawn up by siphon injection & propelled from blasting nozzle by high velocity air stream. Only moving part within cabinet is the blower used for ventilation. Consequently, there are no critical wear points that might need servicing.

Said to effect any desired finish on flat or irregular surface, retaining sharp edges; metal removal can be held to .0001. Work is held in one hand or inserted on work table. Full control over operation is by means of padded knee pedals governing flow of slurry and the cleaning of the light.

Jet Blast machine, manufactured by R. W. Renton and Co.

For additional information Circle No. 196 on the Reader Service Card

AIR IMPACT PRESS FOR RIVETING, ASSEMBLING

FEATURES: Light duty, high speed press is suited for marking, assembling, staking, riveting operations. Automatic controls permit high production rates.

SPECIFICATIONS: Gets up to 10,000 strokes per hour, pressure obtainable up to 8 tons from 100 lb. airline widely adjustable. Permits variations in material thickness and holds impression depths to any desired tolerance.

Cadillac "52" Air Impact Press, manufactured by Cadillac Stamp Co.

For additional information Circle No. 197 on the Reader Service Card

UNIT PERMITS SHORT RUNS OF SMALL DIE CASTINGS

FEATURES: Zinc die casting machine designed for smaller castings and short runs to fill needs of manufacturer who does not need big machine, but wants fast cycling. Also economical for short run work.

SPECIFICATIONS: Capacity is 1½ lbs.; machine is air-operated and is capable of free cycling speed in excess of 1000 shots per hour. Easy set-up & operation makes inexpensive single cavity dies practical.

Electronically controlled panel; 10x10x2½ inch die blocks, 4 tie bars, semi-automatic cycling with adjustable timing dwell on opening & closing of the toggle, are additional features.

Other specs: die thickness standard two halves — 5", max. 7"; die locking pressure 20 tons; die opening 4"; pot capacity 275 lbs zinc; operating air pressure 100-125 psi; electric power 110-125 v AC; weight 2000 lbs; height 66"; width 27"; length 80".

ABC Die Casting Machine Co.

For additional information Circle No. 198 on the Reader Service Card

VERNIER CALIPERS HAVE HANDLING EASE

FEATURES: Redesigned vernier calipers reported to have improved handling ease, convenience & accuracy; have fitted, adjustable vernier plates, both measuring scales on face of the tool, and double-spaced vernier graduations.

SPECIFICATIONS: Highest grade, hardened tool steel construction; tightly-fitted slides are smooth-moving, scales graduated in .025 increments.

Homestrand, Inc.

For additional information Circle No. 199 on the Reader Service Card

continued on page 108

new

AMERICAN

permanized

BIAS SISAL BUFFS

with

PERMANENT STEEL CENTERS

Exclusive "Permanizing" *permanently locks together* the fibres of ALL-NEW, specially woven, bias cut sisal. Reduces fraying, prevents excessive hardness, gives a perfect finish on every job. Permits AMERICAN Bias Sisal Buffs to replace many grease wheel operations.

Air-conditioned steel center gives cooler running at faster speeds, increases machine output, makes buffs wear up to *twice as long!*

Also available with Air-conditioned, Permanent Cardboard Center

"For the Job that's TOUGH... Use an AMERICAN BUFF"

NEW PATENTED "CENTERLESS" TYPE provides extra savings through cooler running and "Pre-Assembly" change-over.

WRITE FOR FREE BUFFING CALCULATOR

— tells what buff to use for every job.

AUTOMATIC BUFF CO.
DIVISION OF **American Buff Company**
Chicago 16, Illinois
CAlumet 5-1607

For additional information Circle No. 39 on the Reader Service Card

We help our customers write success stories

Every day 200 Oakite Technical Service Representatives use Oakite cleaning materials and methods to help thousands of Oakite customers accomplish metal-cleaning jobs that are important parts of big production operations.

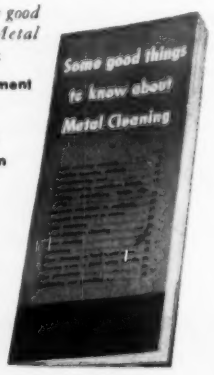
When a busy customer sends a few words of appreciation, we treasure those words as a *success sentence* that we have helped write in his *success story*. Here are brief explanations of the *success sentences* quoted above:

1. After 6 months use of Oakite Special Protective Oil for preventing rusting, this manufacturer of precision steel parts estimated savings at more than $6,000.
2. The use of Oakite Composition No. 95 for conditioning zinc-base die castings before plating cut cleaning rejects for this hardware manufacturer and showed other "very fine advantages."
3. Oakite CrysCoat HC put a heavy phosphate coating on 385,000 shells with "absolutely no trouble" according to a munitions maker, who added that "maintenance and control are very easy."
4. For burnishing, "Oakite Composition No. 3 is here to stay" says this maker of aircraft instrument parts, who adds "Pinions are polished to the roots of the gears. Magnesium parts are brilliant."

How about your success story? We'll be glad to tell you how we can help. Just drop a note to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

FREE Ask for our booklet "*Some good things to know about Metal Cleaning.*" It discusses our methods for:

Tank cleaning	Pre-paint treatment
Machine cleaning	Burnishing
Electrocleaning	Paint stripping
Pickling, deoxidizing	Rust prevention



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

For additional information Circle No. 83 on the Reader Service Card

NEW PRODUCTS — cont.

LEAD SCREW FOR MULTIPLE HEAD TAPPING

FEATURES: Economical, multiple-tapping of 2 or more small holes can be done with lead screw protection by means of this self-contained unit, even when tap sizes, pitches or both are different.

SPECIFICATIONS: Self-contained lead screw multiple tapping unit consists of reversing head, a 3-spindle multiple head and a fixture; taps two 0-80 holes in aluminum. The lead screw, having fast pitch, runs slower than the taps and is completely enclosed during operation for precision and long life.

Ettco-Emrick self-contained lead screw multiple tapping unit manufactured by Ettco Tool Co., Inc.

For additional information Circle No. 200 on the Reader Service Card

THINNEST ROTARY DIVIDING TABLE

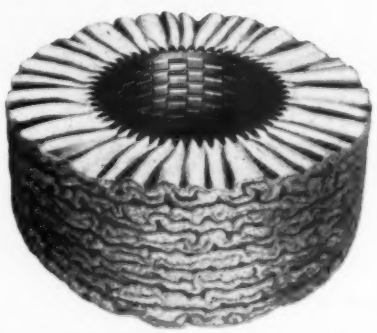
FEATURES: Claimed to be thinnest rotary dividing table in the world to give more capacity under the tool on milling, drilling & jig boring machines.

SPECIFICATIONS: Each table supplied with inspection certificate showing max. error through 180° to be .00025. All castings are heat treated & seasoned; Worm of hardened steel is fitted into an eccentric quill assembly to enable it to be disengaged; Dead-stop is fitted to allow the worm to be re-engaged in correct position; Supplied in lined case.

Hayes "Wafer-Thin" rotary dividing table, manfactured by Hayes Engineers, Ltd., England, & distributed by British Industries Corp.

For additional information Circle No. 201 on the Reader Service Card

IMPROVED CENTERLESS BUFF



FEATURES: Rigid steel ring which securely grips the buff cloth in its channel is designed to retain strength & perfect circumference.

SPECIFICATIONS: Pre-assembly of the automatic centerless buff is accomplished with 2 tubes, each welded inside an automatic buff flange. One tube fits telescopically into the other, and the set-up of buffs is tightly secured between the 2 flanges.

Regularly spaced buff plates for ventilation are securely held by steel gripper teeth on the ring, and radiate from the center. Specially designed air vent plates are available for controlled ventilation.

Automatic centerless buffs, manufactured by American Buff Co.

For additional information Circle No. 202 on the Reader Service Card

USEFUL LITERATURE

To receive copies of the publications described here circle key number on reader service card bound in this issue.

PROCESSES

Iron Cores Produced From Powdered Iron: 137

In a 24-pg. booklet, Pyroferric Co. gives a full presentation on iron cores produced by powder metallurgy. Table of contents shows how cores are manufactured, electrical properties, design considerations, insert cores, threaded cores & cups, inspection & test procedures, information for purchasing agents, and other sections.

Vacuum Die Castings in Nickel-Aluminum-Bronze 138

A complete case history report in Vol. 6, No. 1 of Nickel Topics published by International Nickel Co., Inc., gives much interesting data on the use of a nickel-aluminum-bronze alloy formed by casting in a die under vacuum. The parts described are made by Aurora Metal Co. for Bausch & Lomb. Table of physical properties compares aluminum-bronze alloys with and without nickel.

MATERIALS & EQUIPMENT

Preventing Galling at High Temperatures: 144

An anti-scuffing paste and other molybenised lubricants for special operating conditions such as high temperature lubrication, are covered in 2 pieces of literature available from Ragosine Oil Co. Ltd. of London.

Large Wall Chart of Commonly-Used Metals 145

An unusual metals chart showing compositions of 60 different classes or types of commonly used metals and alloys in industry has been prepared by Sam Tour & Co., Inc. Chart measures app. 16x34" and a 2-pg. explanatory piece accompanies the chart.

Non-Pulsating Air Supply for Fuel Combustion: 146

A centrifugal pressure blower useful for supplying non-pulsating air for gas or oil combustion is the subject of a loose-leaf-punched catalog from Eclipse Fuel Engineering Co. In Catalog K-100, they show methods of installing, piping layout, rotor construction and all dimensions and specifications.

Burner Tips & Heads: 147

American Lava Corp. offers a new bulletin giving details & specs on standard Alco burner tips and heads. Physical characteristics are given. Includes gas burner tips, radiant burner heads, carbon black tips, pilot tips, spuds, caps, removable discs & rings.

Special Die Casting Lubricants: 148

Die casting die lubricants and the special die casting uses for each, are reported in a folder from E. F. Houghton & Co. Lubricants are suggested for various metals, temperatures and type of casting problem.

Dial Bore Gages: 149

Fast, accurate measurement of small bores and internal grooves is reported in a leaflet from Rimat Tool Co. giving specs and illustrations of their new dial bore gages.

Production Drill Press: 150

A production model drill press designed for multiple operations involving drilling, tapping, reaming, burring & chamfering is the subject of new literature put out by South Bend Lathe Works.

Anti-Seize Lubricant: 151

Molylube anti-seize lubricant that does not melt at temperatures above 600 F is reported by Bel-Ray Co., Inc. Said to prevent seizing & galling and also protecting against corrosion.

Determining Flow Rate of Air or Gas: 152

Bulletin from Waukee Engineering Co. announces new line of flow meters for indicating flow rates of air & industrial gases. Available in 11 sizes. Meter has built-in calibration for specific gas to be measured.

Core & Mold Ovens: 153

In newly issued bulletin 53CM, The Carl Mayer Co. presents a line of core & mold ovens, including rack, car, vertical, horizontal monorail, rolling drawer, portable and special ovens. Heat treating furnaces & ingot mold dryers are also included.

Producing a Perfect Thread: 154

A threading tool which is said to produce a perfect thread independent of operator skill is reported in a new bulletin from Rivett Lathe & Grinder, Inc.

Casting for Machine Parts: 155

A new 6-pg folder describing Colmonoy castings for machine parts that must resist wear, corrosion, impact, indentation & high temperature is now available from Diamonds & Tools, Inc.

Hydraulic Copying Machine: 156

A new Bondycop hydraulic copying machine for use on milling machines has been announced in literature from Morey Machinery Co., Inc. Unit permits machining of complicated shapes.

Chilling for Alloy Steel Heat Treating: 157

Sub-Zero chilling for alloy steel heat treating, metal stabilization, gas dehydration and parts & materials testing is explained in a new 12-pg brochure from Sub-Zero Products Co.

continued next page

USEFUL LITERATURE

continued from page 109

Recommended procedures for Barrel Finishing: 165

In a barrel finishing bulletin issued by Wyandotte Chemicals Corp., recommended procedures for the bulk finishing of various types of metal parts is offered. Description of the process and operations which can be accomplished are also part of the publication.

Cleaning Compounds for Electroplaters: 166

A pocket-size booklet from Magnuson Products Corp. is devoted to cleaning compounds for electroplating shops. It includes non-electrolytic and electrolytic cleaning compounds, as well as reference to barrel finishing, aluminum cleaning, safety & first aid, and conversion factors.

Buff Bulletin: 167

Hanson-Van Winkle-Munning Co. has released a new 12-pg bulletin on disc-type buffs for cutting & coloring. Text tells when to use & how to specify pieced buffs, full disc buffs & ventilated buffs.

Air-Inflated Contour Wheel: 168

A contact wheel for abrasive belt grinding, introduced in a folder from Nu-Matic Grinders, Inc., features a rubber, air-inflated drum which follows the contour of irregular shapes. Different pressures in the rubber drum, and different band grits, can produce varied surface finish.

Use of Rectifiers: 169

A brochure explaining the application of rectifiers to various operations has been made available by American Rectifier Corp. Question-and-answer folder is devoted to queries most frequently received.

Data Card on Alodine: 170

Compact source of information about Alodine, a non-electrolytic surface conversion coating for aluminum, is contained in a single **Chemical Paint Co. data card.**

Compressed Air Power in Industry: 171

A 33-pg pamphlet containing 63 illustrations has been prepared by The Compressed Air and Gas Institute devoted to "Compressed Air Power in Industrial Production." Pamphlet presents information on air power usage in many uses, including drilling, grinding, molding, die casting and others.

Protective Coating in Tape Form: 172

An 8-pg booklet from The Tapecoat coal tar protective coatings supplied in tape form.

ADHERES to almost any metal INVISIBLE on all of them

DULAC Clear Universal Lacquer #462—a *single* water-white lacquer with remarkable adhesion to practically *all* metals. Finishing shop after finishing shop* reports that this M & W lacquer can be applied with *equal* success to just about any metal—and that it's invisible when applied. AND . . . tests conducted by an unbiased laboratory show that DULAC #462 withstands salt spray and weatherometer tests for longer periods than ordinary lacquers.

DULAC #462 forms a tough, lasting protective film that resists heat, cold, weather, stain, perspiration. It cuts *inventories*, because one lacquer handles so many metals. It cuts *production time*, because it dries out of dust in 5 to 10 minutes . . . hard in an hour. Applied by spray or dip.

*Names on request

PIONEERS IN PROTECTION — 70th YEAR — 1876

For complete information, write for Technical Data Bulletin #110.

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Midwest Div.: 1658 Carroll Ave., Chicago 12, Ill. • Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Cal.

MANUFACTURERS OF INDUSTRIAL FINISHES

For additional information Circle No. 82 on the Reader Service Card

NEW PRODUCT BRIEFS

210 INDEXING CENTERS for small precision work manufactured by South Bend Lathe takes stock up to 5" diam. x 6" length. Useful for dividing, making splines, flutes & gears, as well as milling, shaping & grinding squares, hexes or odd angles.

211 ELECTRIC IMPACT WRENCH handles up to ⅞" nuts & bolts, weighs 16¾ lbs. and has spindle speed of 1800 rpm. Pistol grip with detachable side handle, die cast aluminum housing, heavy duty gears, forced draft ventilation. Built by Mall Tool Co.

212 HOSE COUPLINGS and fittings designed to be coupled or uncoupled in half a second or less offered by Hose Accessories Co. Work equally well on air, water, gas, oil, hydraulic or steam lines. Spring locked to prevent accidental uncoupling. Handles work pressures to 2,000 lbs. in hydraulic service.

213 CORROSION-RESISTANT GASKETING from U. S. Stoneware Co. described in new literature giving basic compositions & physical characteristics of Tygon gasketing.

ASTE MEETS

A panel discussion on "Hard to Machine Materials", reports of special research on grinding of geometric sections and a tour of the new million-dollar machine tool laboratory of Purdue University at Lafayette, Indiana, will feature the Tool Engineering Conference at Purdue on April 18, sponsored by Indiana chapters of the American Society of Tool Engineers.

The one-day technical conference for the 1,000 members of the six Indiana ASTE chapters is in line with the national education program of the 25,000-member, 104 chapter national technical society which has chapters in both the United States and Canada.

Speaker for the noon luncheon and toastmaster for the evening dinner will be Roger F. Waindle, national first vice-president of ASTE and vice-president of the Cannon-Muskegon Corp. of Muskegon, Mich.

METAL POWDERS, METAL ABRASIVES & METAL PIGMENTS

A new 250-page indexed book, known as the "MD Blue Book", has just been issued by the Metals Disintegrating Co., Inc. manufacturers of Metal Powders, Metal Pigments and Metal Abrasives.

Thoroughly indexed, this book contains authoratative information on all of the company's products. In addition a separate section gives technical data and computations relavant to the various products.

The section on metal powders is a liberal education in the art and science of the manufacture and use of sinterings. A glossary and bibliography are included in this as well as all other sections.

Intended as a reference for executives actively concerned with the purchase of the products covered the book may be secured free by qualified individuals. For a copy, inquire on your letterhead of Metals Disintegrating Co., Elizabeth, N. J.

Circle No. 123 on the Reader Service Card

PRES-ON ABRASIVE DISCS are used for roughing, cleaning and finishing operations on Dies, Moulds, Castings, Forging and Metal Patterns. They can be used on all types of grinders. Coated with pressure sensitive adhesive of exceptional holding strength, application is made in seconds by "pressing the disc on". Disc is held firmly and will not slide. For replacement it easily peels off. Used with PRES-ON Flexible Disc Holders which are made of soft flexible rubber capable of conforming to the severest contours without digging. Discs are available in ½" to 20" dia., Grits 24 to 320.

Write for circular and price list

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14-16 S. Clinton St., Chicago 6, Ill.

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REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

2. PRECISION CASTINGS from frozen mercury patterns described in bulletin from Alloy Precision.
10. HYDRAULIC PUMPS that reduce fire risk & cut fluid costs in die casting machines are reported in Aldrich Pump catalog.
11. HOW TO BE SURE of buying "on-grade" zinc die castings is the subject of an American Die Casting Institute brochure.
13. OIL-RETAINING BEARINGS produced by Bound Brook Oil-Less Bearing Co. are listed, described & illustrated in a catalog.
16. DIE CASTING MACHINE catalog shows complete line of die casting machines built by Cast Master.
21. DIE CASTINGS is title of booklet from Hoover Co. Die Casting Div., describing company facilities & giving design information.
23. DIE CASTING MACHINES from Hydraulic Press Mfg. Co. are described & illustrated in a specification catalog.
25. SAFE OPERATING TEMPERATURES for hydraulic fluids in die casting machines with heat exchangers discussed in Kewanee-Ross booklet.
26. MOST COMPLETE LINE of presses for powder metallurgy listed, illustrated, described in Kux Machine catalog.
28. NON-FLAMMABLE FLUID for die casting machines reviewed in 12-pg booklet on Pydraul F-9 from Monsanto.
32. CLOSE-UP OF DIE CASTING is title of informative brochure from Pressure Castings.
37. STAINLESS STEEL POWDERS that are pre-alloyed (grades 302-b and 316) are subject of technical literature from Vanadium-Alloys.
38. HEAT TREATING METAL is subject of 40-pg book from Westinghouse called "Harnessing Heat."
39. FREE BUFFING CALCULATOR from American Buff Co. tells what buff to use for every finishing job.
40. DRILL UNIT with hydraulic feed, air-powered traverse & electrically driven spindle is introduced in brochure from Bellows Co.
41. THREAD-CUTTING SCREWS developed especially for assembling die castings are presented in literature from Central Screw.
42. THREAD-CUTTING SCREWS to make planned assemblies pay off is subject of booklet from Parker-Kalon.
45. CORRECT BLENDING OF POWDER with J. H. Day mixing & blending equipment for powder metallurgy is reported in catalog.
47. CUSTOM ALLOY POWDERS for alloy steel compositions are discussed in detail in technical literature from Metal Hydrides.
49. GEARS BY POWDER METALLURGY is subject of literature from Michigan Powder Metals.
50. TWO BOOKLETS from Monarch Aluminum give information on die castings & permanent mold castings for product designers.
51. DIMENSIONING DIE CASTINGS is subject of a guide book from Newton-New Haven Co.
52. DIE DESIGNING SERVICE for die castings is fully explained in illustrated brochure from Permanent Mold Die.
56. IRIDITE PROTECTIVE systems for corrosion-resistant metal surfaces are outlined in brochure from Allied Research Products.
57. METAL PRESERVATION & paint adhesion with chemical treatments produced by American Chemical Paint Co. can be learned in technical literature.
58. PRECISION FINISHING by means of barrel techniques are discussed in detail in Roto-Finish Co.'s new catalog.
60. ALUMINUM & ZINC die castings produced by Advance Tool & Die Casting Co. are introduced in new booklet.
64. ADVANCED POWDER METALLURGY is title of new piece of reference material from Dixon Sintaloy.
66. CENTRIFUGAL INVESTMENT castings produced by Electronicast are subject of folder on the process & its applications.
67. SMALL DIE CASTINGS — review of size, alloy & design limits in a folder from Gries Reproducer. Also includes sample castings.
68. ALLOY SUPPLIERS, Henning Bros. & Smith, offer monthly house organ called the Henning Messenger.
72. HOW TO DESIGN aluminum & magnesium die castings is subject of data book from Litemetal Dicast.
75. TOOLS FOR DIE WORK & a regrinding service are in "All Star" catalog from Severance Tool Industries.
78. PLASTIC PATTERNS for investment casting produced on injection molding machines manufactured by Van Dorn Iron Works indicated in catalog.
79. IMPROVED TUMBLING UNIT is reported in new literature from Abbott Ball describing Abbott Method of barrel finishing.
80. HOW TO SELECT COATED abrasives is pointed out in easy-to-use data book from Carborundum.
81. PLATING BARRELS and auxiliary equipment are covered in catalog from Daniels Plating Barrel Co.
82. WATER-WHITE LACQUER that is invisible & clings to all metals is subject of data sheets from Maas & Waldstein.

continued from page 114

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Just figure your assembly expense as compared to total production cost, and you'll see why. In some products it runs as high as 75%.

Cutting assembly costs is Parker-Kalon's specialty. You get a two-way savings. First, the Self-tapping Screw method, originated by P-K, permits you to save by eliminating needless operations. Second, with certified Self-tapping Screws of P-K guaranteed quality, you can make sure *planned* savings *pay off* on the assembly line.

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*This mark △ on every P-K Self-tapping Screw identifies it as genuine.

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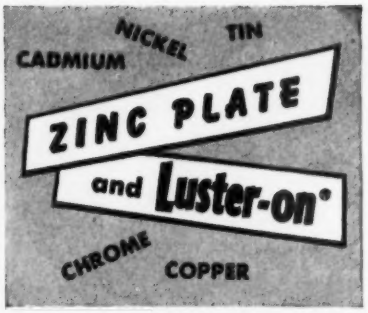

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ONE FINISH STANDS OUT

Study METAL COST

ZINC is the cheapest metal to plate. Even with LUSTER-ON Passivating Dip added it still COSTS LESS than Cadmium, Copper, Nickel and Chrome or any other finish that we know of today.

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Zinc plate with simple Luster-on cold dip treatment will usually SAVE 2/3 of the PROCESSING TIME of flash copper, nickel and chrome work. TIME COSTS YOU MONEY — SAVE IT WITH LUSTER-ON.

Study POWER COST

Zinc plate and Luster-on require no heavy power to plate or heat metals such as nickel and chrome. YOU SAVE ON POWER USED and RECTIFIER or GENERATOR EQUIPMENT REQUIRED.

Study THE FINISH

Zinc and Luster-on, applied manually or in full automatics, can nowadays show finishes so beautiful, so gleaming that they bow to no one. Proved again and again superior to cadmium for most purposes, they rival traditional chrome.

Study ALL ANGLES

You'll soon see why big companies and job shops alike agree that Zinc and Luster-on is here to stay — has established itself over the years, not just as a substitute for scarce metals. BUT BE SURE THE PASSIVATING DIP YOU USE IS GENUINE Luster-on — "The first in the field and still the leader."

Write for free data sheets and send a part for free processing.

Circle No. 108 on the Reader Service Card

REFERENCE MATERIAL — cont.

83. GOOD THINGS TO KNOW about metal cleaning is title of comprehensive brochure from Oakite.
84. DATA ON METALS produced by American Metal Co. are offered.
85. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.
87. DESIGN DATA on powdered metal parts is offered in booklet from Chicago Powdered Metal Products.
88. GRAY IRON permanent mold castings information is available from Dostal Foundry.
90. ELECTRIC SINTERING furnaces are subject of descriptive literature from Electric Furnace Co.
92. SEPARATING METAL POWDERS into different particle sizes by means of Federal Classifier equipment is explained in two bulletins from the company.
96. DESIGNING FOR POWDER metallurgy is subject of handbook from International Powder Metallurgy.

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ZINC
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die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.
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Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.
RACINE DIE CASTING CO.

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Circle No. 124 on the Reader Service Card

97. SAMPLE OF COPPER POWDER having fernlike particle shape offered by Malone Metal Powders.
99. MAGNETIC IRON POWDERS are discussed in technical literature offered by Magnetic Powders.
101. STANDARD BEARING LIST is subject of stock bearing list from National Molded Products.
106. ZINC PLATE with chemical passivating dip for brilliant chrome-like finishes is covered in data sheets from Luster-On.
107. PERMANENT MOLD & sand castings are subjects of an illustrated brochure from Aluminum Permanent Mold Co.
109. ELECTRIC FURNACES for melting high temperature investment casting alloys reported in literature from Detroit Electric Furnace.
110. SAMPLES OF STEARATES to improve green strength of powdered metal parts offered by Metasap.
112. JOB STUDY BROCHURE shows analysis of pieces cast in plaster molds by Ohio Precision.
113. REFERENCE FOLDER on line of P-V investments for investment casting process offered by Pre-Vest.
114. DIE CASTING PLANT, equipment & personnel of Republic Die Casting are presented in illustrated brochure.
116. HOW TO HEAT WAX for investment casting patterns explained in literature from Sta-Warm Electric.
120. AIR-OPERATED DEVICES manufactured by Mead Specialties are reported in a complete catalog.
121. HIGH-SPEED TAPPING heads are described in literature from Procunier Safety Chuck Co.
123. ABRASIVE DISC circular includes specifications & price lists from Metal Removal Co.
126. REVISED EDITION of 22-pg booklet on barrel finishing methods has up-to-date information from Almco Div., Queen Stove Works.
127. BARREL FINISHING methods and equipment are comprehensively outlined and illustrated in brochure from Minnesota Mining & Mfg.

Pattern Dies for INVESTMENT CASTING

By S. LIPSON* and H. ROSENTHAL*

Part 2

Die making techniques

Determination of shrinkage allowances — Determination of shrinkage allowances is based on experience with a given process and alloy. Where shrinkage of the wax pattern is restrained, as would be the case with a large core, less than the "rule of thumb" correction should be applied. When a stock part is available, it is often good practice to make a cast die and complete a few castings. The dimensional changes occurring between the stock part and the investment casting can be applied in making the correction for dimensioning either the master pattern or the machined die.

If this technique is applied for dimensioning a machined die, it is better practice to compare the actual dimensions of the cast die with the casting obtained. This is necessary because many of the fusible alloys exhibit growth characteristics.

If experience and judgment alone are applied in determination of the die dimensions, it is well to consider methods of adjustment of the die dimensions, should it prove necessary. Plating can be used to advantage sometimes in correcting a die or master pattern. Shims can be inserted to alter the size of the pattern, or metal can be removed from appropriate surfaces.

Average shrinkage allowances vary between one and three percent, depending on the method used in the shop concerned.

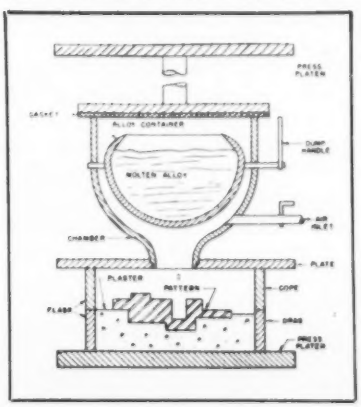
Casting — Pressure casting of pattern dies is performed with a comparatively simple equipment. Figure 12 shows a typical pressure casting device. The parting line for the component is first developed by blocking out one of the halves with plaster, clay or other suitable material. This is done with the master pattern positioned within a flask or hard shell container.

The molten alloy is poured into the ladle within the pressure casting machine, the chamber is sealed off, and the application of air pressure is coordinated with tilting the ladle of metal.

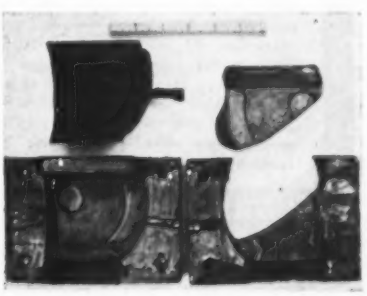
This operation produces the first half of the die. The plaster blocking out material is then removed and the second half of the die is cast by repeating the process. It is necessary to apply a parting material to

continued next page

12. SCHEMATIC illustration of pressure casting apparatus for making fusible alloy dies.



13. DIE PARTS and wax patterns showing split coring technique to free pattern from large core.

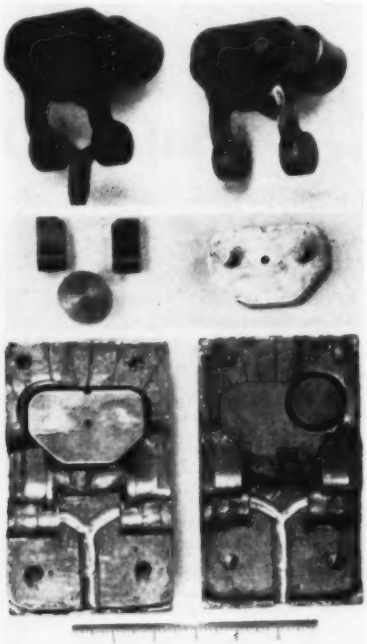


*Metallurgist, Pitman Dunn Laboratories, Frankford Arsenal, Philadelphia, Pa.

the parting surface of the first die half to prevent fusion of the metal. One effective method of accomplishing this is to soot the surface with a smoky acetylene flame.

If the component requires more than two die parts, the process is repeated until all the necessary parts have been cast and mated. Figure 13 shows a die which required a cast core in addition to two die halves. If a two part die were made to produce this casting, it would have been very difficult to remove the pattern from the cored section. By dividing the cored die half into two separate parts, one of these parts can be removed while the die is still closed. This relieves the pressure of the shrinking wax which would have seized the core.

The die was made by first blocking out the half which contains the two parts and casting the solid half. The pattern was then placed in this half and again the half was blocked out leaving the area



14. WAX PATTERN, master pattern and cores, above. Master pattern is assembled by soldering brass components together. The section to be cored is left solid and the separate core fitted to the die to mate with the guide pins. Die halves (below) are shown with brass cores inserted.

to be cored open. The core was then cast. The remaining plaster was then removed and the last part of the die cast.

The pattern for this casting was produced by soldering pieces together to form the desired shape. Since the part is quite large it was easier to do this than to machine the piece out of a solid block.

The possibility of adopting labor saving techniques such as these lowers the cost of pattern manufacture to less than would be necessary to produce one of the desired components (in the alloy specified) by conventional machining practice.

Figure 14 shows another die which illustrates an expedient which simplifies the manufacture of the master pattern. In

continued on page 121

here's how BIG INDUSTRIES SAVE on SMALL PARTS

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PARTS FOR **Toy** Products

DIE CAST BY GRIES IN ONE OPERATION

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For additional information Circle No. 67 on the Reader Service Card

NATIONAL CARBIDE DIE ADDS KEY PERSONNEL

The National Carbide Die Company, McKeesport, Pa., has announced the addition of three new members to its operating and sales staff. J. W. "Bill" Mehaffey has joined the organization as general plant manager, Andrew Marhefka, superintendent, and R. W. Ehrhard as sales representative in the Chicago area.

Mr. Mehaffey was previously production planning supervisor with Firth Sterling Steel and Carbide Corp. for a period of 12 years. Mr. Marhefka had also been with Firth Sterling previously. Mr. Ehrhard, whose address is 1707 Dundee Rd., Northbrook, Ill., was formerly a die engineer for Kennametal, Inc., and is a member of both ASTE and ASME.

R. W. Ehrhard

Bill Mehaffey

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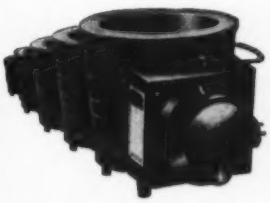
This Wax Melting Equipment
melts wax fast and efficiently

You can depend upon the Sta-Warm line of wax melting equipment to heat the wax you use safely, completely, fast and efficiently.

For many years, Sta-Warm has studied the engineering of electric heat as applied to pots, kettles, tanks, hose, valves and accessories. Installations in largest American industrial plants . . . and abroad . . . have led to repeat installations on the basis of satisfactory performance.



Sta-Warm takes the guesswork out of wax melting installations, offers you dependable equipment in a wide variety of sizes.

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BARREL COMPOUNDS
continued from page 105

plished by the use of agents like trisodium phosphate.

Degreasing agents used in the barrel will not always completely remove heavy oils and greases in one run. Should this be the case, however, it is possible to do a good job by pre-degreasing with the material for five minutes, rinsing the barrel, and degreasing again with the same compound for another five or ten minutes. Usually, 2 to 4 ounces per gallon of water used, is the correct amount with this type of compound for proper degreasing.

Scale and rust removal

Scale and rust removal compounds are designed to loosen and dissolve heat-treat scale and rust from ferrous parts. These compounds are usually acidic in nature, although there are a few alkaline scale removal compounds available. In general, the acidic cleaners are more rapid in their action.

The major constituents of this group of compounds should contain:

Acidic component

This will be the primary agent in loosening and dissolving scale and is usually a substance like sodium bisulfate. Ordinary salt is sometimes added with the above to form a stronger acid radical.

A wetting agent

A wetting agent should be present to help with free rinsing. Soap is not suitable because it is destroyed in acid solution to form the greasy acid from which it is derived. Therefore, a synthetic detergent must be used which is stable in acids.

An abrasive material

As an aid in removing heavy scale and rust, an abrasive material such as quartz, garnet or aluminum oxide is often added to the above composition to supplement the abrading action of the media.

Basically, this is sufficent for a scale and rust removal compound, although, sometimes, special inhibitors are added to retard possible etching which the acid may cause.

These compounds may be used in one of two ways. If it is desired to remove an exceedingly heavy scale, they are used in a manner similar to that described under abrasive compounds with a very low water level. On the other hand, if the scale or rust is a light deposit, they may be used in amounts of about four ounces per gallon of water with a water level which is

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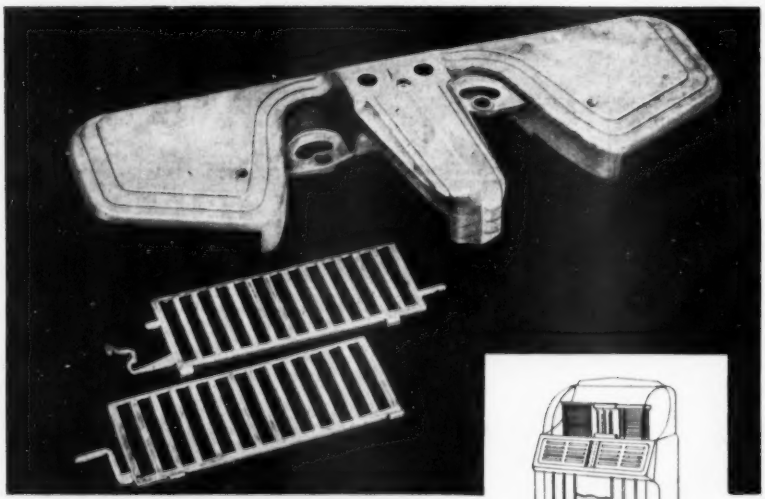

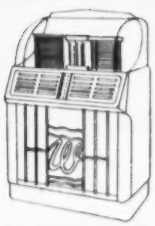

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about two to four inches below load level.

It is possible for the barrel finisher to quickly examine a compound for the various ingredients mentioned, if he is unable to get this information from the particular company from which he is buying his products. A complete analysis is more difficult and also more informative, but this is usually not a necessary procedure.

Simple tests for compounds

Simple tests follow which can be performed to tell qualitatively the nature of compounds as described above. Two teaspoonfuls of the compound are dissolved in about ¾ of a glass of water and the following observations are made.

Alkalinity-acidity determination

A test with litmus paper, available at any pharmacy, will indicate if the substance is alkaline or acid in water solution. The paper will turn from red to blue if the solution is alkaline or blue to red, if it is acid. To tell more exactly the pH (or the strength of alkalinity or acidity, in other words) test papers such as pHydrion papers may be obtained from a chemical supply house and used as directed.

Abrasive content

Abrasive materials used in barrel finishing compounds are not soluble in water so by dissolving the soaps, detergents and other chemicals in water and letting the abrasive settle to the bottom of a glass, it can be easily separated. Then, by the color of the residue, the general type of abrasive is recognized as below.

1. Quartz is pure white in color.
2. Garnet is a reddish or light brown hue.
3. Silicon carbide (carborundum) is black and scale like.
4. Aluminum oxide (usually fused) is brown or very dark unless it is exceedingly pure, then, it is grey or white.

All the above are gritty and will scratch glass when rubbed against it.

Soap content or detergent content

If, upon rapid agitation of the solution, foaming takes place, it is usually indicative that either a soap or detergent is present. If the compound is acidic, the substance must be a detergent, for soaps are not stable in acids. If the solution is alkaline and the "feel" when rubbed between the fingers is slippery, then, a soap is probably present because synthetic detergents do not have this lubricating property. If a "curd" settles out upon the addition of enough household

continued next page

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vinegar to make the solution acid, then, it is soap which imparts the lubricity and not a special additive.

Rust inhibitors

Sodium chromate as a rust inhibitor will color the solution an unmistakable bright yellow color. Soda ash as an inhibitor will foam and bubble when vinegar is added to the dry compound. Borax, when heated on a knife blade in a flame, will froth at first and finally melt into a glassy substance.

Lubricating substances other than soap

If very little water is mixed with the dry compound and mulled well with the fingers, a very slimy feel is noted if the substance contains special lubricants. It is hard to rinse free from the hands by using only water, and even ordinary bar soap becomes more slippery when hand cleansing is attempted. This indicates the presence of substances such as methyl cellulose or carboxymethycelluse lubricators.

Oil emulsifier

A very popular oil additive to burnishing compounds is pine oil. This can be identified by its clean pine-like odor and by the "softness" which it imparts to a handful of the compound when squeezed together.

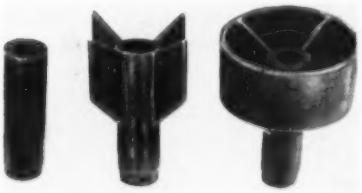
All the above information should aid the barrel finisher in making his decisions on the choice of compounds. He should consult reliable companies for further information concerning their products for they will be able to help him immeasurably. It should be noted that an article such as this cannot cover completely all the myriad of compounds on the market, but it will give, basically, the composition and proper uses of the better products in the field today.

continued from page 116

the previous section it was pointed out that it is desirable to have removable cores whenever possible. In producing the die shown in Figure 14 the following alternatives existed:

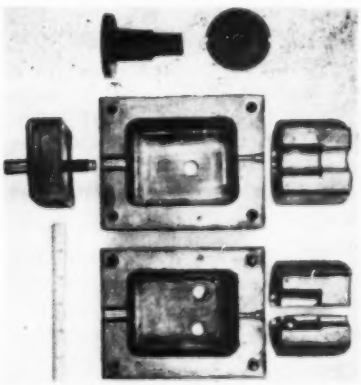
1. Cast the core as a separate member.
2. Machine a core which would fit into the machined cavity in the master pattern.
3. Machine a core but not to machine the core cavity.

The third alternative was elected. Here again the master pattern was assembled from components by soldering; however, the cored section was made from a solid piece of metal. The core was also machined from a solid piece and holes for guide pins were drilled with the two pieces clamped together. The guide pins were then inserted in both pattern and core. After the pattern die was cast and the master pattern removed, the core locating pins were inserted in the guide hole cast originally with the master pattern. The core was further secured by drilling a hole through the back of the die and continuing the hole through the entire thickness of the core. The hole in the core was then tapped and the core secured to the die by means of a screw which extended through to seal off the exposed hole in the core. When the pattern and core were removed from the die, the hole functioned as a vacuum release to ease removal of the core. It was also necessary to provide a stripper to avoid damage to the pattern when the core was pulled.



15. **SEQUENCE of assembly of pattern.**

16. **MULTIPLE PART cast die into brass shell. Holes in shell provide entry for die metal.**



Castings which ordinarily would require an unusually complicated mold can often be made with less difficulty by the assembly of two or more separately molded wax patterns. In this way, castings which present difficult parting problems can be produced

continued next page

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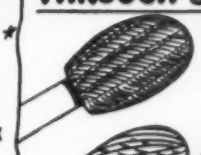

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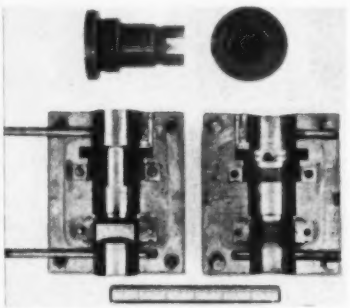
easily. Although this technique is not ordinarily restricted to cast dies, its application is more often justified when this type of die is used. Machined steel dies are usually made of many parts and it is relatively easy to design the die so that the disassembly sequence will free any undercuts inherent in the design.

Aside from reducing a given pattern design into simpler components, the pattern assembly method, in some instances, makes possible the attainment of closer dimensional tolerances. An example is the use of a separately cast lug pattern for the casting might be cited. If the lug is not axially aligned with the rest of the casting, it would be very difficult to design a die which would permit ready removal of the pattern if the lug is integral. Projections of this type are also difficult to control dimensionally because the wax shrinkage is restrained. The final location of the lug is greatly dependent on the shrinkage which takes place after the pattern is removed from the die. The use of a separately cast lug pattern permits its attachment after the pattern has attained dimensional stability. Any initial miscalculation in its location can conveniently be corrected by adjustment of the locating fixture.

Figure 15 shows the assembly sequence used to cast a shrouded fin component. This casting has been reduced to three simple forms. The stem which is the small diameter cylinder, the large diameter



17. TWO PART DIE with cores cast into brass shell. Fusible alloy die halves are keyed into shell.

shroud, and the flat plates which form the fins.

When the shape of a casting is such that it can be freely withdrawn from a single mold cavity and the balance of the shape is a flat plane, it is possible to use what may be termed a one-piece die. The flat part of the pattern is placed on a flat plate and the lead cast around the rest of the pattern contour. The sprue hole can now be cut into the desired section of the die half and the flat plate used to seal the cavity.

When a multiple cavity cast die is desired, two techniques are available for producing the die. One method is to produce

continued on page 125

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lugs, etc., mean different tolerance possibilities for different sections. In Figure 2, we have shown drawings of two such parts illustrating the range of limits for different sections. Because the designer has, in the case of Part "A", recognized the principal of tolerance control for cost control, he has realized the maximum results from his part for the quality level involved. Imagine how much this same part would cost if it were made by any other process than powder metallurgy.

Part "B", Figure 2, was formerly a cast part. Since it was a cast part, additional operations were necessary to smooth off the surface for proper operation. Here is an example where sintered iron parts can be substituted with nominal tolerances, and you can be sure that the surfaces will be smooth enough for proper operation.

Tolerance control with the coining operation added

One important point to remember is that although piece cost is increased by adding the coining operation, you are thereby refining this part to the point where it falls into a higher quality level. As a precision piece, this part cannot be compared, either costwise or functionally, with the former part where only the basic operations are planned. Closer dimensional control and better wearing surfaces will be obtained as a result of this coining operation. Figure 3 should help in determining the tolerances to use for sintered bronze precision bearings.

Sintered iron bushings are more difficult to repress and harder on tools than are the non-ferrous ones. This means that tolerances cannot be held as closely on certain size bearings. In Figure 3 commercial tolerances are given for iron sinterings. It will be important to know that when the bearing length of a sintered iron bushing exceeds 3 inches, problems are encountered which should be discussed with the fabricator.

There is no accepted rule which can be used to determine tolerances on specially shaped, coined iron sinterings. The rules in the preceding paragraph can be used except where thin or varying section thicknesses might cause dimensional instability. To obtain a better picture of tolerance possibilities in this field, let's examine the limits specified on a coined ratchet and gear. Figure 4 illustrates the tolerances specified on a coined ratchet. As a result of this coining operation, the diameters will be accurately held and have excellent wear resistance.

continued next page

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It is very important that tolerances be specified on critical gear dimensions so that the dies will produce the properly matched dimensions for the size gear needed. Problems of die construction and molding are not the same as those of hobbing, and it is necessary to check and recheck gear data before die construction is started. Remember that dies cannot be readily changed for slight changes in tooth shape, and with the relatively high cost of gear dies you should make sure you have given the sintered-metal manufacturer all the pertinent information possible.

Figure 5 will give a general idea of the limits which can be specified on sintered iron, coined gears. Two critical tolerances should be kept in mind when designing sintered gears: The diameter over pins should have a minimum total tolerance of .004 and the chordal tooth thickness tolerance .001.

Problems of concentricity and center distance

Concentricity is always a problem with the manufacturer of sinterings. The fact that there has to be some clearance between the die and the punches means that a briquette might be forced over to one side of the die when the punches begin to exert pressure. The result is a thicker wall on one side than on the other and consequently a bearing or part is produced slightly eccentric. Standard tolerances on concentricity are .003 total indicator reading. Under the usual circumstances, it can be assumed that .002, total indicator reading, is as close as can be molded. If a closer tolerance is necessary, some type of machining operation is needed.

The last design factor to consider is center distance tolerances. When a punch press stamps holes in a plate, relatively close center distance tolerances can be specified between the holes. In molding from powdered metals, however, the problem is not the same. The briquette will have the holes molded in the part. When it is sintered, the piece might be distorted. If the holes are slightly off center after sintering, the cores in the coining die will tend to correct this condition by making the holes "egg shaped". As a result, a total tolerance of .004 should be specified where the center distance is ½ inch or less. When the center distance goes up as high as 1½ inches, .006 total tolerance is necessary.

Now that we've covered important problems in determining tolerance control for cost control, let's sit back and get our perspective. Briefly stated, you will get the best results when using sintered material if first you determine in what quality level or degree of tolerance control you are working. Then with your knowledge of this process and its limitations, you can design for maximum results and minimum costs.

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a master pattern having a double shrinkage allowance. This is used to cast a single cavity die. The patterns obtained from this die are invested and the required number of components cast. These castings correspond dimensionally to single shrinkage allowance master patterns. They are then cleaned and filed to remove undercuts and checked dimensionally. The castings are then set up in plaster in the same manner as before and the cast die is produced with the desired number of cavities.

The second method is to produce the required number of single cavity dies and to assemble the dies to form the multiple cavity pattern die. This method is the simpler of the two. The separately cast dies are squared off and lined up on a flat plate. The back ends of the dies are then joined by means of a soldering iron. This is accomplished easily since the low melting temperature of the alloy permits a deep sound weld by this simple technique. With the dies still held together the assembly is reversed and the operation repeated on the second die half. The two halves may now be separated and the runners and sprue cut at the appropriate location.

The individual dies used in this assembly are easily produced by using the first die for blocking out the parting line for the latter dies. This insures that every cavity in the final die will be identical. It is sometimes desirable to install each half of the multiple cavity die into a simple clamp arrangement to insure permanency of the assembly.

The use of a hard shell to increase the dimensional stability of the cast fusible alloy die has been mentioned previously. Dies of this type are shown in Figures 16 and 17.

Pressing — For small parts the pressing method is sometimes useful. The master pattern is set up in the same manner as for casting and the first half is carefully poured by gravity. The blocking out material is then removed and a cardboard mask about 1/16 in. thick is placed over the embedded pattern. The mask is cut as closely as possible to conform with the outline of the pattern. With the mask in place the second half of the die is poured. The halves are then separated and the mask removed. The function of the mask during casting is to provide metal to move during the pressing operation.

The die is reassembled and heated to just below the melting point of the alloy. Pressure is then gently applied until the two halves flow together. This operation irons out any surface defects occurring during the casting cycle.

Centrifuging — Centrifugal force may be substituted for air pressure in casting the die halves. Since a considerable

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amount of weight is spun, it is necessary that a sturdy accurately counterbalanced machine be used. The setup technique does not differ from that used for other types of cast dies.

Machined Dies — These dies differ from the type used in the plastic molding and die casting industry in that the designer can exercise a great deal of freedom in the selection of materials and the construction details of the die. The pressures used in the injection of wax patterns rarely exceed a few thousand psi. Therefore, the mechanical strength requirements are moderate. Many liberties may be taken with the design that could not be tolerated in die design practice in other industries.

The advantage of this type die is its long life, dimensional accuracy, good venting, and ease of removal of the pattern. The higher cost of this type die, however, often limits its application.

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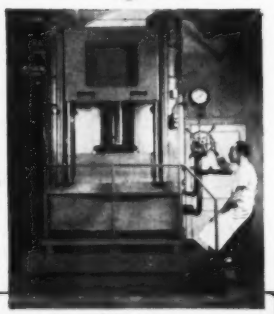

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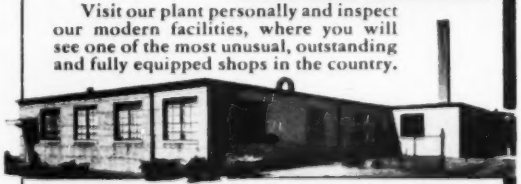

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SINTERINGS FOR PLUMBING
continued from page 35

When extrusions were used, normal delivery of the tube stock was from 60 to 90 days. A second delay would occur while machining of the extruded stock was done. With sinterings, delivery is usually within a very few days and the parts are received ready for use.

A second intangible advantage gained by conversion to sinterings was the reduction of inspecton costs and the substantial elimination of rejects. With machined extrusions, it was necessary to inspect incoming extruded stock and the finished part. Any manufacturing errors that occurred during machining represented a loss to the parts consumer. With sinterings, practically no inspection of incoming stock is required and if defective parts are found, they are the responsibility of the fabricator, not the consumer. In those cases where there had been a high rate or rejections, this factor alone can be of utmost importance.

Die costs

The cost of dies for manufacturing sinterings is often given as one of the major drawbacks to converson. In the case of the gland "F", the die costs were about $700.00 and the savings on the first order was over $900.00 so that not only was the die charge immediately amortized but on this first shipment, a small additional saving was shown. This favorable condition does not always exist, but on a stable item where the dies can be used for long total runs, even very expensive dies will be amortized readily.

Finishing

On plumbing brass, it is essential that many parts be chromium plated. One of the criticisms leveled at sinterings has been that they do not take a good plate. In the case of brass sinterings, this objection is completely invalid. Such parts can be, and in some cases, are beng chromium plated as readily as wrought and cast brass parts. The plating cycle is the same and the resultant finish is certainy the equal of the best produced on machined parts. In many cases where a machined sand casting is used, sub-surface porosity will be uncovered during machining. While this may in no manner affect the functioning of the part, it does prevent the attainment of a really good plated finish. With brass sinterings, such porosity is completely absent. (For finishes applicable to sinterings, see PRECISION METAL MOLDING magazine for Sept, 1951; April 1952; June 1952).

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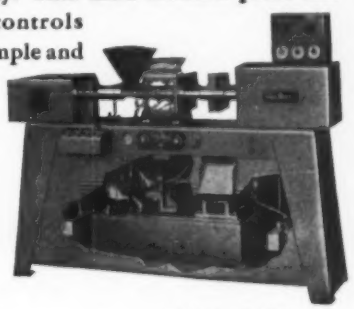

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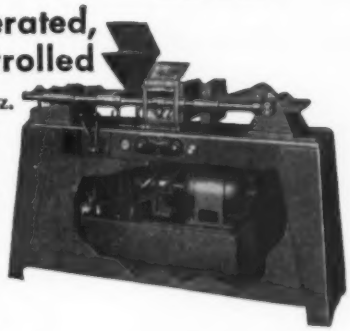
Power-Operated, Lever-Controlled Presses — 2-oz. or 1-oz. models. Have many automatic and safety features.



MODEL H-200

Plastic Grinder — grinds up waste, rejects, etc., for re-use.

Mold Bases for these presses available from stock.

MODEL G-100

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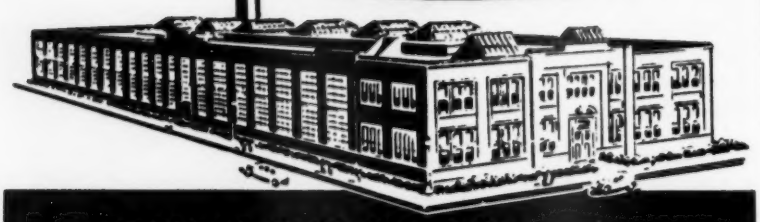

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CURRENT RESEARCH
continued from page 42

we shall pursue more fully soon, are:

Fragmentation- forming as a substitute for pressing,

A way of welding cermets to alloys,

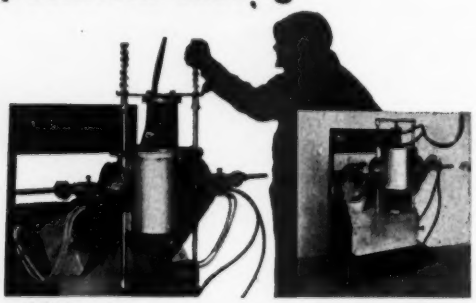
A study of the effects of grinding on cermets,

A method of modifying the surface structure and residual-stress pattern in TiC cermets, and

The technique of metallographic preparation for these materials.

Apart from the cermet work, our measurements of the surface energy of solid metals continues. Since this is the driving force in sintering, we are interested in its behavior in the presence of various atmospheres and impurities.

Direct-casting Electric Furnace for better, faster precision investment casting



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The new, type IC, 12 kw., 10-lb. Detroit Electric Furnace melts and pours heats of chrome-nickel, Stellite or superalloy steels in 9-12 minutes. Casting is done by inverting the furnace, pouring directly into the investment mold which is held in place by air pressure. Melting by fast, controlled, indirect arc minimizes carbon pickup and alloy variation. Simple, efficient operation is ideal for high production of precision castings.

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Perhaps the most important "research" in powder metallurgy today is the study of ways of interesting young men in this fast-growing subject, and of ways of teaching them what they should know. We are active in this study also.

ZINC INSTITUTE MEETING

The American Zinc Institute will hold its 35th annual meeting at the Hotel Statler, St. Louis, Mo. on Monday and Tuesday, April 27 and 28. Competent speakers will discuss topics of vital interest to the zinc industry. A review of the production picture here and abroad will bring up-to-date information to the audience.

LETTERS TO THE EDITOR
continued from page 20

and therefore would appreciate the name and address of any reliable concern manufacturing this item.

In regard to your publication, we would like to extend our thanks to you for the copies which we receive and find there are many excellent articles. — R. H. L.

Information sent. — Ed.

F. J. KOEGLER NEW V. P.

Directors of National Lead Company have made F. J. Koegler a vice-president of the company and general manager of its newly-formed Doehler-Jarvis Division. He will direct National Lead's operations in die casting.

Mr. Koegler started with Doehler-Jarvis Corporation on December 12, 1913. He became treasurer and a director of the corporation in 1926, a vice-president in 1933, executive vice-president in 1948 and president in January of last year. He makes his headquarters in Toledo.

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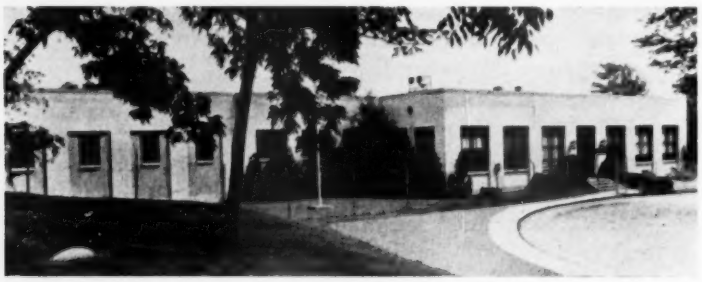
INDUSTRY NEWS

Fabricator of Sinterings Expands; Dixon Sintaloy Opens New Plant



Recognizing the rapid growth of the powder metal industry and faced with the immediate need for considerable expansion of their sintered parts' manufacturing facilities, the management of the Joseph Dixon Crucible Company recently formed a new subsidiary, Dixon Sintaloy Inc. A plant was purchased in Stamford, Conn. Following acquisition of the property and buildings, work commenced to equip the plant for quantity production of sinterings in ferrous and non-ferrous alloys.

The plant is of modern, one story design and contains more than 18,000 square feet of production area.

One important feature of the new plant is the system of humidity control. The need for precise humidity control, in order to maintain uniform conditions at every point throughout the entire manufacturing cycle, has been recognized.

The control and research laboratory has been equipped with the latest research tools available including equipment for analysis of oxide and carbon content. Machine tool equipment has been installed for the manufacture and maintenance of a high percentage of its tool and die requirements. Special form grinding equipment, together with precision optical measuring devices, have been incorporated in the new tooling set-up.

In order to complete the expansion program as quickly as possible, the complete sintered metal production facilities of the Waterbury Companies were purchased and combined with the existing and new production facilities.

The press department includes banks of presses with working capacities ranging from three to 200 tons. The sintering department has medium and high temperature production sintering furnaces.

One of the immediate objectives of the corporation is to put into large scale production, as rapidly as possible, a new process for producing high density, high strength steel parts by the powder metallurgy technique. This new process is the result of more than ten years of intensive research and development work.

OPEN WESTERN PLANT

Lindberg Engineering Company, Chicago, Ill. opened its new West Coast plant at 11937 South Regentview Ave., Downy, Calif., March 25.

This new factory comprises 12,000 sq. ft. of production and office space and will be used to manufacture industrial heat treating furnaces and other Lindberg products used in aircraft and other West Coast industries.

JOHN R. HARTLEY APPOINTED FACTORY MANAGER

John R. Hartley has been appointed factory manager of the Die Casting Division, Cleveland Hardware & Forging Co., 3256 East 79th St., Cleveland, Ohio, it has been announced by A. J. Sanford, president of the company.

John R. Hartley

Mr. Hartley has been with Cleveland Hardware for 20 years. He has had experience in almost every department, having started in the casting department. He has served as sales engineer, improvement engineer and assistant factory manager.

Cleveland Hardware's Die Casting Division produces zinc and aluminum die castings.

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SALES ENGINEER with die casting or similar background wanted for Metropolitan New York and New England territories. Write Box 4553 Precision Metal Molding Magazine.

MANUFACTURERS REPRESENTATIVE covering northern Illinois and Wisconsin for die casting and plastic molding firms desires also to represent a reputable investment casting house having ambition to expand. Exclusive area coverage basis only. Reply Box No. 4453, Precision Metal Molding magazine

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ANTIOCH PROCESS
continued from page 45

that can be cast. On the other hand, castings that run less than a pound are regularly produced.

SURFACE FINISH — Regular production by this process gives castings with a surface finish of 125 microinch RMS or better. In some cases a 30 microinch has been produced. Plaster mold casting can do as well, but sand casting cannot even approach this fine surface finish in regular production.

DIMENSIONAL ACCURACY — The quotation of tolerances that can be met is a dangerous procedure. Every casting is a case unto itself and must be judged accordingly. However, by the Antioch process, aluminum castings have been produced up to eight feet in diameter where the deviation over the diameter was less than ± 0.050. This sort of accuracy is not, of course, standard but does illustrate what the process is capable of doing.

METALLURGICAL QUALITY — One of the great disadvantages of casting aluminum in a sand mold is that the casting tends to be porous and due to the physical weakness of the mold material, a sufficient number of chills sometimes are not included. As a result, the castings are often highly stressed and metallurgically unsound.

With the Antioch process, the mold material has sufficient physical strength to accommodate as many chills as are required for the best foundry practice. As a result the rate of cooling can be controlled to a nice degree to produce a sound casting. Castings are produced as a matter of routine which will withstand pressures of 1500 psi on a wall thickness of only 5/16 inch with no impregnation. These castings meet the highest quality standards for por-

osity and other metallurgical defects.

INTRICACY OF CASTINGS — While every industrial designer strives to make parts as simple as possible, there are cases where a rather intricate casting would do the job far better than an assembly. This is particularly true when it is necessary to have re-entrant angles and undercuts. When casting in sand, these are generally impossible and the casting must be machined as a secondary step.

Because of the high set strength of molds made by the Antioch process, it has been found possible to use pattern parts made of rubber. Generally, vinyl chloride or thiocol rubber is used for this purpose. The rubber is anchored to a rigid back so that it is always held in exact alignment and position, but has enough flexibility so that it will deform when pulled from a rigid mold.

If the mold material is adequately strong, as it is in this

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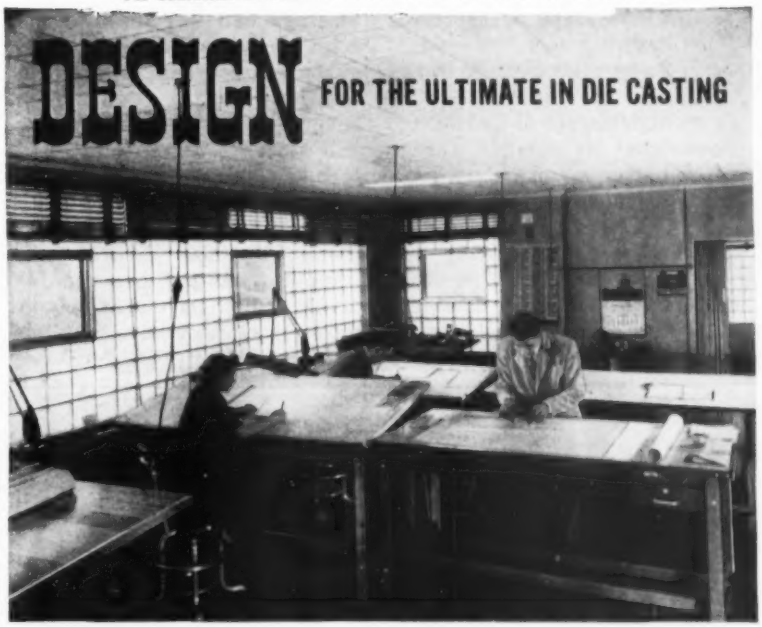

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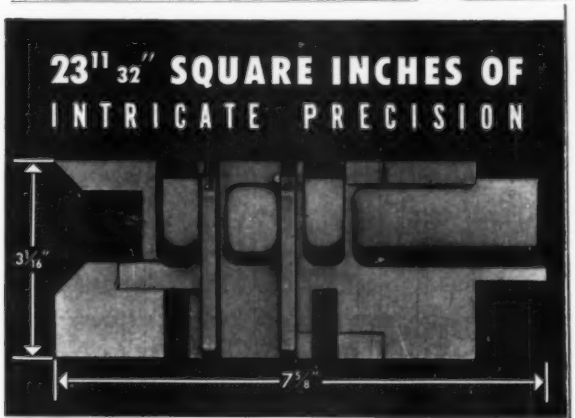

This OPC casting, made of high tensile manganese bronze (SAE #430, Grade A) is an article bucket. As a component part of a Redington high-speed, continuous-loading, cartoning machine, it can be drilled, reamed and tapped—ready for machine assembly—in just 20 minutes. The same intricate detail, smooth finish and exceptional accuracy evidenced in this OPC casting may help you save time, money and manpower on your production, assembly or experimental work.

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case, there is no damage to the mold and the rubber, because of its high degree of flexibility, re-assumes its original shape. Such patterns can be used repeatedly with no loss in detail.

While it is easy to understand how many of the advantages claimed for this process are true for small castings, it is not so apparent why large castings can be made to the high degree of accuracy and surface finish that is claimed.

Attention has been called several times to the high physical strength of the mold materials. Because of this high strength, it is possible to make the mold in a plurality of pieces, assemble them into a complete mold. Since the individual mold parts can be held to very close tolerances, the overall accuracy of the assembled mold can be high. This is particularly true of circular parts where it is easier to assemble the component pieces on special layout tables and where the casting can be done while the mold is still on the table.

Considerable stress has been placed upon the high physical strength of the molds. They are, after processing, sufficiently low in compressive strength so that the mold parts will crush when the metal contracts after solidification. Thus, instead of having a part with either distorted sections due to a rigid mold or high locked-in stresses, the mold will crumble allowing normal thermal movement of the casting. This pecularity of gypsum-bonded sand molds is another of the advantages of the process that tends to give castings of better accuracy and lower residual stresses.

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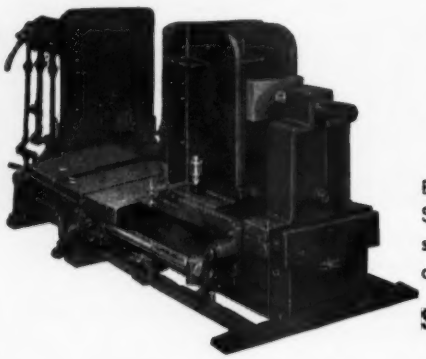

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We have some customers who have been with us since we started in business, and we promise you the same kind of service that has kept these customers satisfied for so many years. Let us quote on your prints.

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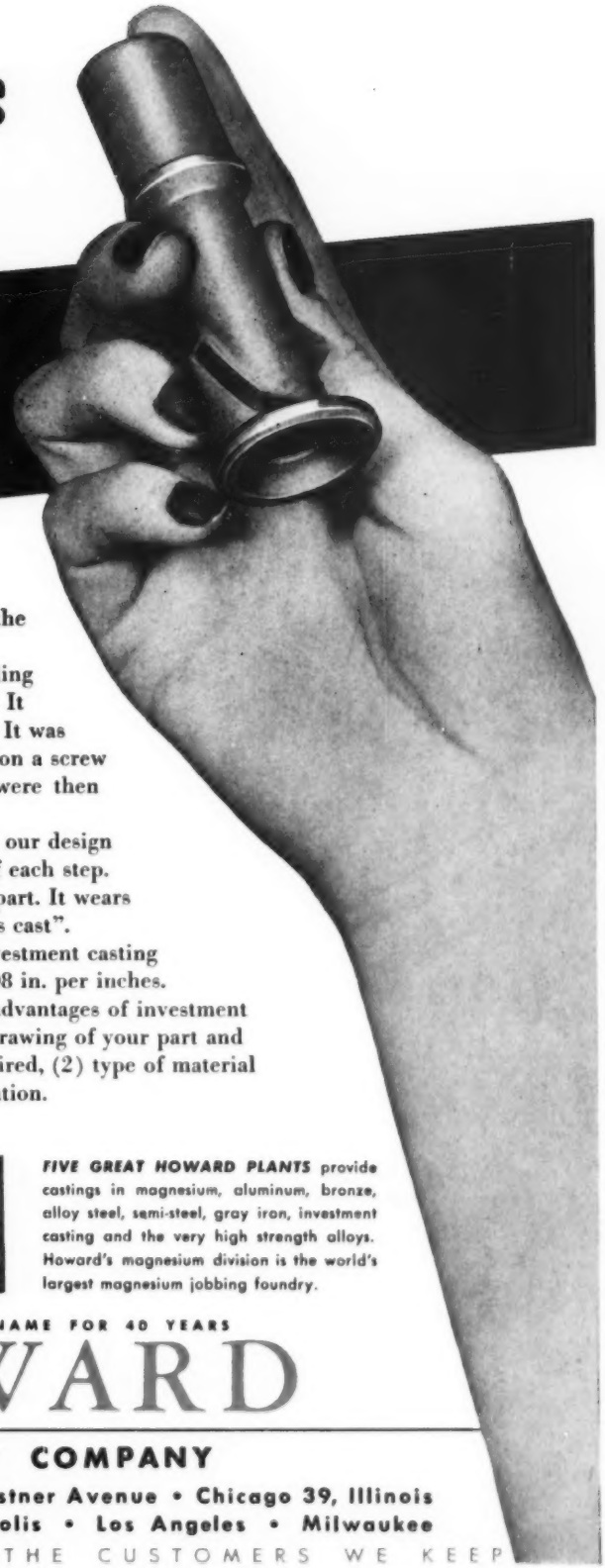
Will You Cut Production Costs by Changing to INVESTMENT CASTING?



Our design engineers answered this question for the manufacturer whose application you see here.

This is a vent tube sleeve for a milk bottle filling machine. The tube is made of 18-8 stainless steel. It wasn't originally designed for investment casting. It was fabricated. One part of the tube was blanked out on a screw machine. Another part was milled. Both parts were then silver soldered together.

All these fabrication steps were eliminated by our design engineers. So was the extra time and extra cost of each step.

This Howard investment cast part is a better part. It wears better, fits better and has a velvet-like surface "as cast". Little machining is needed, because Howard's investment casting engineers hold tolerances from ±.003 in. to ±.008 in. per inches.

You may cut your production costs with the advantages of investment casting by Howard. To find out by mail, send a drawing of your part and a sample, if possible. Tells us (1) quantities required, (2) type of material and (3) permissable tolerances. There's no obligation.

WRITE TODAY on your business letterhead for Investment Castings by Howard—a 12-minute 16 mm. color sound film. Give date desired, size of group. Your date filled, if possible. All films scheduled at least 30 days in advance.

INVESTMENT CASTING MOVIE

FIVE GREAT HOWARD PLANTS provide castings in magnesium, aluminum, bronze, alloy steel, semi-steel, gray iron, investment casting and the very high strength alloys. Howard's magnesium division is the world's largest magnesium jobbing foundry.

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